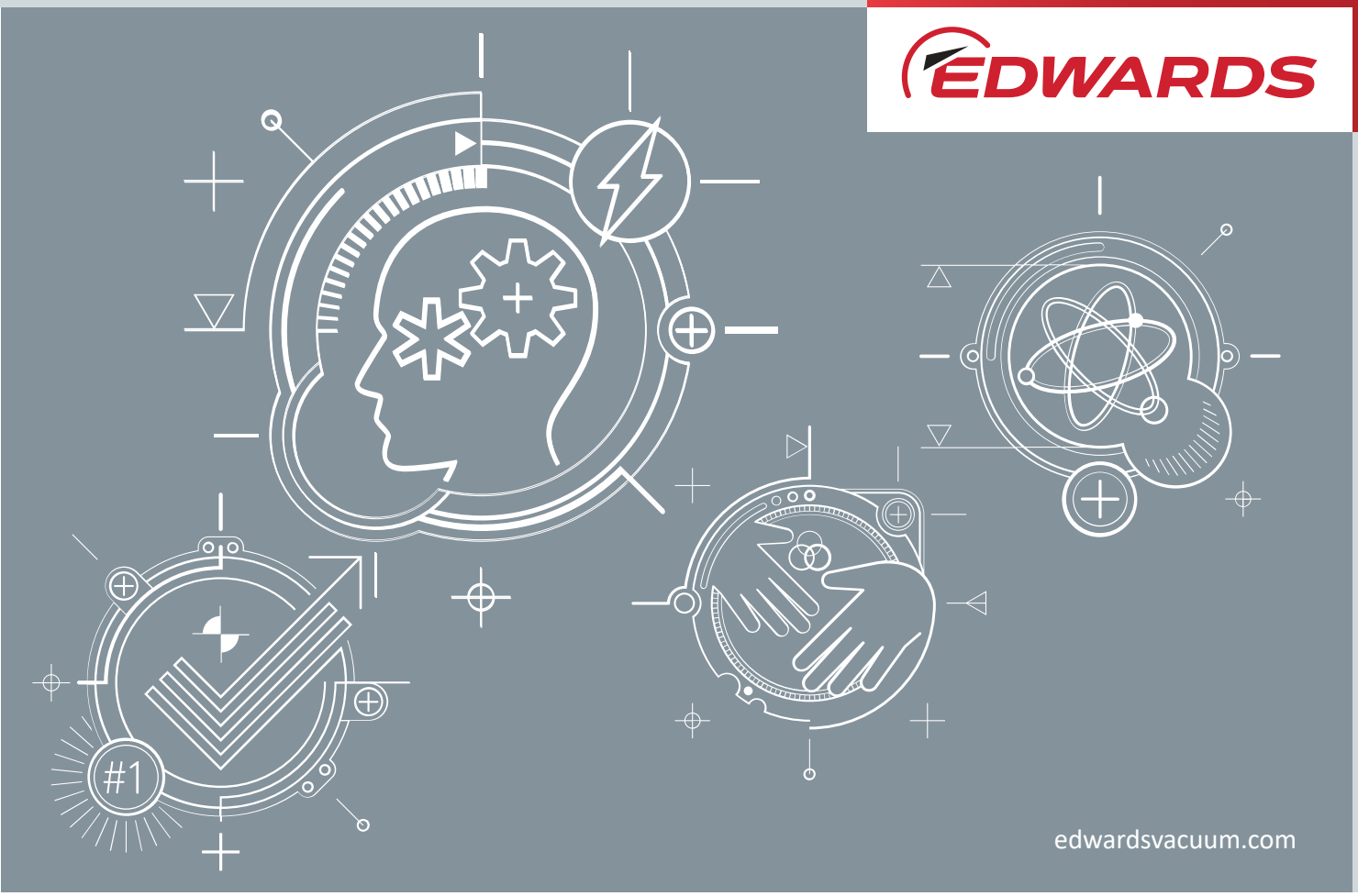

RS232/RS485 Interface

FOR NEXT MAGLEV PUMPS

301270454_002_C0

Original instructions

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Published: 9/18/2024

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We accept no liability for loss of profit, loss of market or any other indirect or consequential loss whatsoever.

Product warranty and limit of liability are dealt with in our standard terms and conditions of sale or negotiated contract under which this document is supplied.

You must use this product as described in this manual. Read the manual before you install, operate, or maintain the product. For manual enquiries, email *manuals@edwardsvacuum.com*.

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1. Safety and compliance

For safe operation from the start, read these instructions carefully before you install or commission the equipment and keep them safe for future use. Read all the safety instructions in this section and the rest of this manual carefully and make sure that you obey these instructions.

The instruction manual is an important safety document that we often deliver digitally. It is your responsibility to keep the instruction manual available and visible while working with the equipment. Please download the digital version of the instruction manual for use on your device or print it if a device will not be available.

1.1 Definition of Warnings and Cautions

Important safety information is highlighted as warning and caution instructions which are defined as follows. Different symbols are used according to the type of hazard.

WARNING:

If you do not obey a warning, there is a risk of injury or death.

CAUTION:

If you do not obey a caution, there is a risk of minor injury, damage to equipment, related equipment or process.

NOTICE:

Information about properties or instructions for an action which, if ignored, will cause damage to the equipment.

We reserve the right to change the design and the stated data. The illustrations are not binding.

1.2 Trained personnel

For the operation of this equipment “trained personnel” are:

- skilled workers with knowledge in the fields of mechanics, electrical engineering, pollution abatement and vacuum technology and
- personnel specially trained for the operation of vacuum pumps

1.3 Safety symbols

The safety symbols on the products show the areas where care and attention is necessary.

The safety symbols that we use on the product or in the product documentation have the following meanings:

	**Warning/Caution** Risk of injury and/or damage to equipment. An appropriate safety instruction must be followed or a potential hazard exists.

2. Introduction

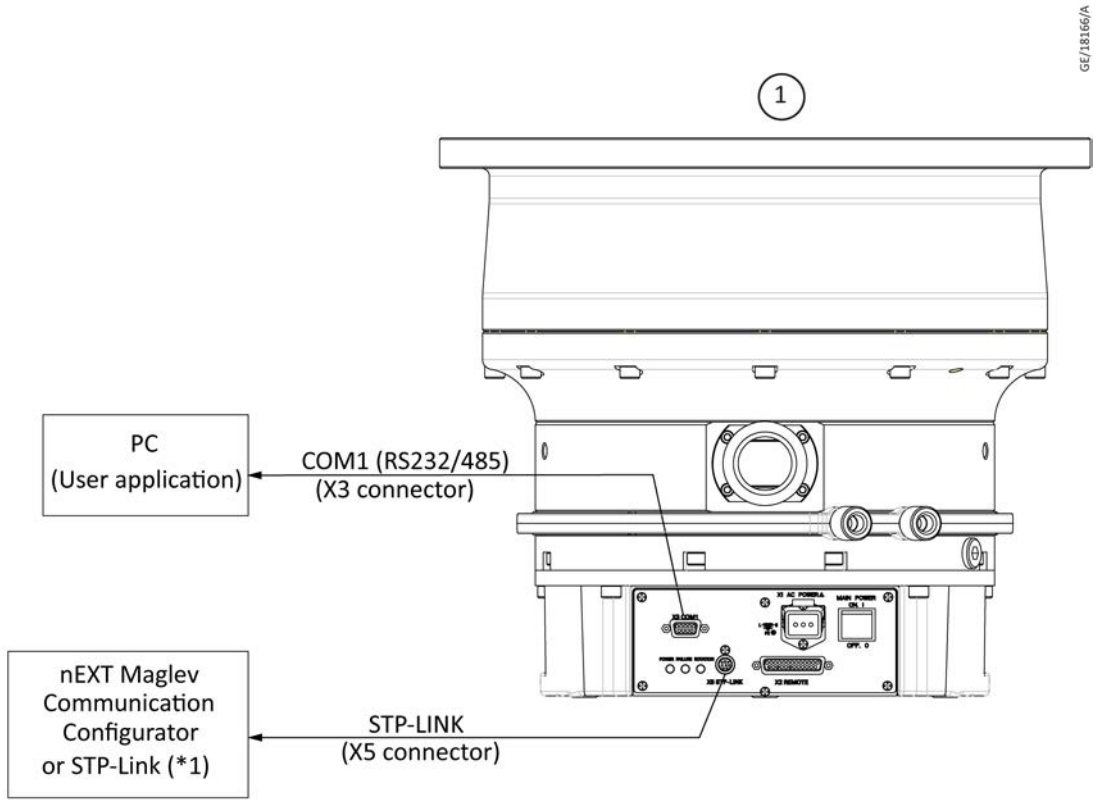
The pump is provided with compliant serial RS232 or RS485 interface. Prepare the user application according to this protocol procedure. Operation instructions and information such as the running state and setting values of the pump can be set by the software.

The pump has the serial ports for connecting the user application.

The RS232/RS485 variant is equipped with 2 serial ports COM1 and STP-LINK.

A serial port in the pump is called serial interface module (SIM). The equipment, which can communicate with the pump via RS232/RS485 is called PC.

Figure 1 Serial port



*(*1) MAG iS Communication Configurator is provided on https://www.edwardsvacuum.com/en-uk/vacuum-pumps/our-products/software/. For STP-Link, contact us.*

1. *nEXT Maglev pumps*

3. Connection and setting up

3.1 Signal connection

- Serial Port COM1 (X3 COM1 connector)

  The serial port COM1 is available for the serial communication via RS232 or RS485. When using a user application, connect it to this port.

  Connect the connector X3 (D-Sub9 pin, socket type) to the PC according to *Table: X3 pin position*. Connect only TxD/RxD/GND to the RS232 and D+/D- to the RS485. Do not connect other pins which are reserved for optional use. Do not use a commercially available straight cable to which all lines are connected.

  However, when using the Profibus (optional accessory), serial communication function is not available because of the different connector pin position. (refer to the instruction manual of the Profibus)

  The RS232 and RS485 share the X3 COM1 port.

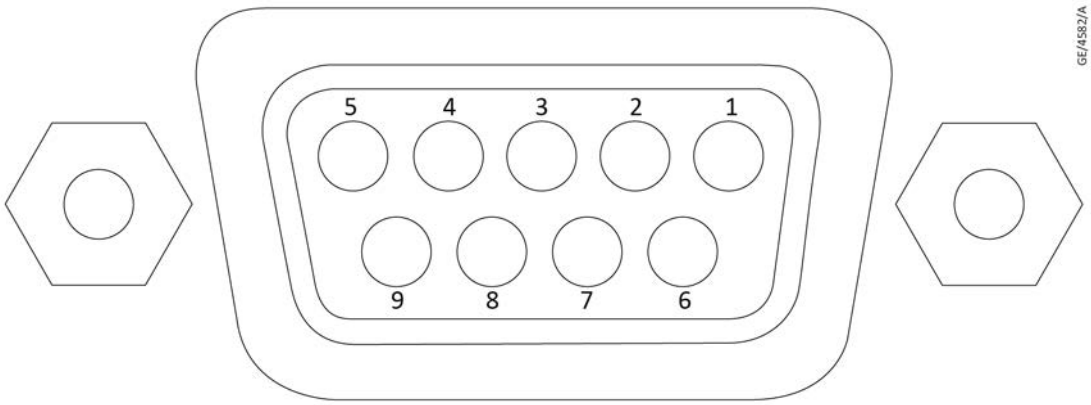
  When connecting RS232, the length of the communication cable must be 15 m or less. When connecting RS485, refer to *Connect the RS485* on page 10.

Table 1 X3 pin position

Interface	X3 (D-Sub9 pin, socket)
RS232	2 (TxD)
	3 (RxD)
	5 (GND)
RS485	7 (D-)
	8 (D+)
Reserved	1, 4, 6*, 9

** The pin 6 of the connector X3 outputs 5 V d.c. for option units. Do not connect the pin 6 as it may damage the peripheral equipment, such as PC.*

Figure 2 X3 connector (D-Sub9)



Note:

The connector X3 is fitted using M2.6 screws.

- STP-LINK (X5 connector)

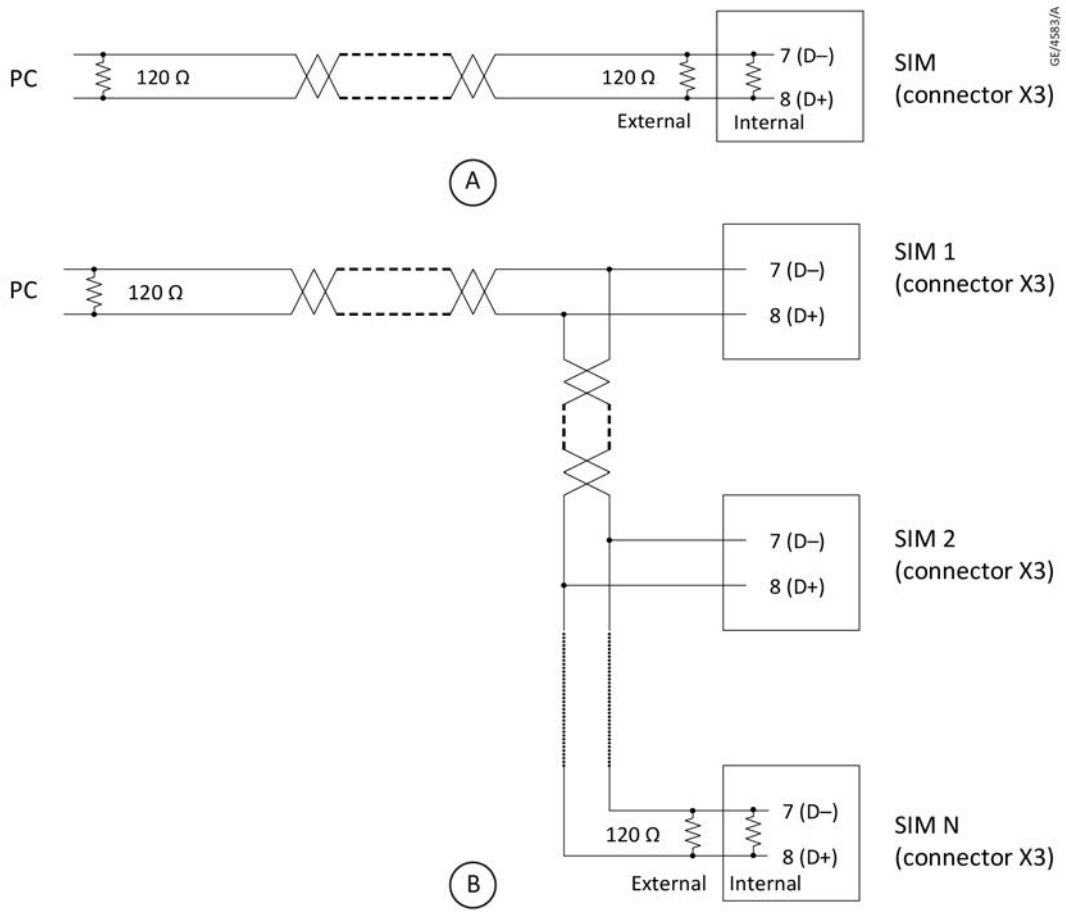
  The STP-Link or nEXT Maglev Communication Configurator can be connected to the STP-LINK.

3.2 Connect the RS485

When you use the serial port COM1 with RS485, make sure that:

- A connection condition is 1 on 1 (single point connection) or 1 on N (multi-point connection).
  A maximum number of 32 SIMs are connectable in the multi-point connection.
- After receiving commands, SIM will respond after approximately 5 msec at the shortest. Connect the PC for which transmit/receive switch time is 5 msec or less.
- Use twisted-pair wire in communication cable. The extended communication cables must be 1.2 km or less.
- Connect the terminator to the communication devices at both ends of the transmission line. The external terminator (120 Ω, 0.25 W) is required for connection.
- The internal terminator of the pump side is available. When using it, set it by nEXT Maglev Communication Configurator or STP-Link. Do not use an internal terminator and an external terminator at the same time. Communication failure may occur.

Figure 3 RS485 connections



A. RS485 single point connections *B. RS485 multi-point connections*

3.3 Communication parameter setting

The factory setting of COM1 is shown in *Table: Communication parameters*. To set communication parameters, use the nEXT Maglev Communication Configurator or STP-Link.

Table 2 Communication parameters

Communication parameter	Factory setting	PC setting example
Baud rate	9,600 bps	1,200 to 56,000 bps
Bit length	8 bit	7, 8 bit
Stop bit	1 bit	1, 2 bit
Parity	None	None, Even, Odd
Driver type	RS232/RS485 single	RS232/RS485 single, RS485 multi
RS485ID *1	1	1 to 127
Terminator	Not use	Not use, Use

**1 - used in RS485 multi.*

3.4 Input operation port setting

Set the input operation port to the serial port when you operate the pump via the X3 COM1 or X5 STP-LINK.

Set the "Input operation port" parameter to the serial port which operates pump, following *ReadOptionFunc* on page 47. The parameter value of the factory setting is "I/O REMOTE" (parallel port). The "input operation port" can also be changed via the nEXT Maglev Communication Configurator or STP-Link.

Table 3 Input operation port

Port type	Input operation port	Remark
Parallel port	I/O Remote	X2 REMOTE connector
Serial port	COM1	X3 COM1 connector, Profibus (optional accessory)
	STP-LINK	X5 STP-LINK connector

Note:

Any commands other than pump operation are effective in every port regardless of the input operation port setting.

3.5 Serial communication timeout setting

If the signal to the input operation port of the pump is interrupted for a certain period during acceleration or normal operation, the pump detects a failure and stops. The time setting of the failure detection is user definable. When setting the value to 0, the function is disabled. This value will be common to all serial ports and the factory setting is 1 minute.

The setting value can be changed via serial communication (refer to *SetOptionFunc* on page 50), nEXT Maglev Communication Configurator or STP-Link.

Design the user application so that the PC can communicate with the pump at fixed regular intervals within the setting time, except when the function is disabled (the value is 0).

Table 4 Serial communication time out setting

Parameter	Default	Setting range	Remark
Serial communication time out setting	1 minute	0 to 500 minutes (1 minute step)	The function is disabled when the value is set to 0.

Note:

When the communication time out is disabled, the pump may not stop if the serial communication does not function normally due to a breakage of the communication cable. In this case, interrupt the power supply for 2 seconds or more to stop the pump by power failure detection. Supply the power to the pump immediately after power failure detection.

3.6 Recommended items about communication cable installation

Noise is generated by many factors such as the type or length of cable and communication speed. Different communication devices may cause the communication failure with a serial port. It is very difficult to prevent a communication failure completely. The followings are valid methods to countermeasure against a noise for the communication cable.

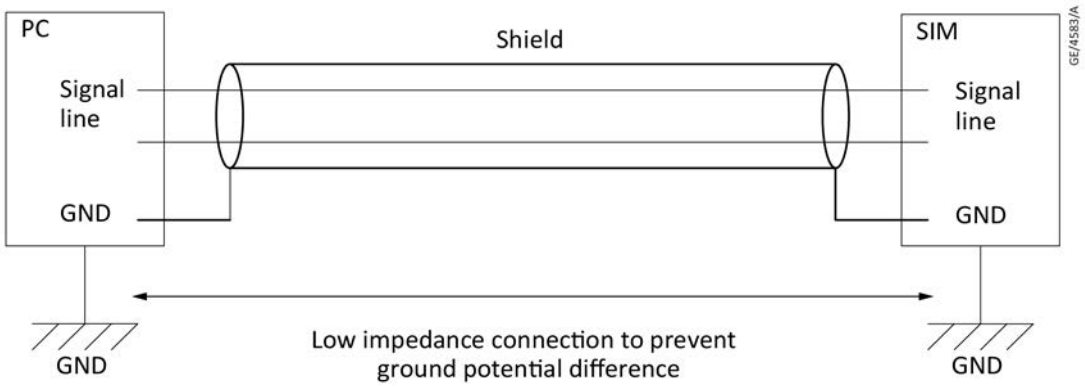
- Use a shield type product for communication cable and an EMI countermeasure product for the communication connector hood. Choose the suitable grounding method according to the operating environment.

3.6.1 Both ends grounding (Electromagnetic shielding)

This is the grounding method for reducing the inducted voltage produced in the communication line by the magnetic field emitted from a power supply line.

- Ground both ends of the shield.
- Clamp the pump side shield on a connector hood.
- Make a ground loop through both ends grounding.
- Connect between GND of a pump and a PC with low impedance to prevent ground potential difference.

Figure 4 Grounding example (both ends grounding)

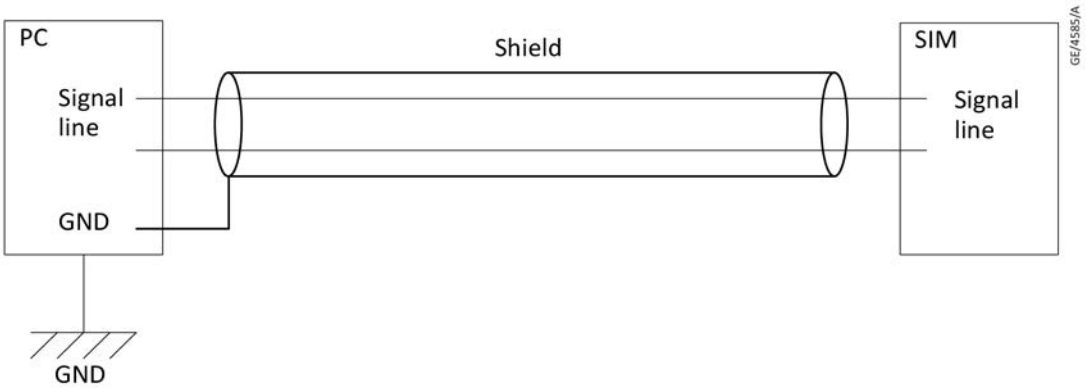


3.6.2 Single point grounding (Electrostatic shield)

This is the grounding method for reducing the electrostatic induction produced in the communication line by the exogenous noise caused by electrostatic induction or unnecessary radiation.

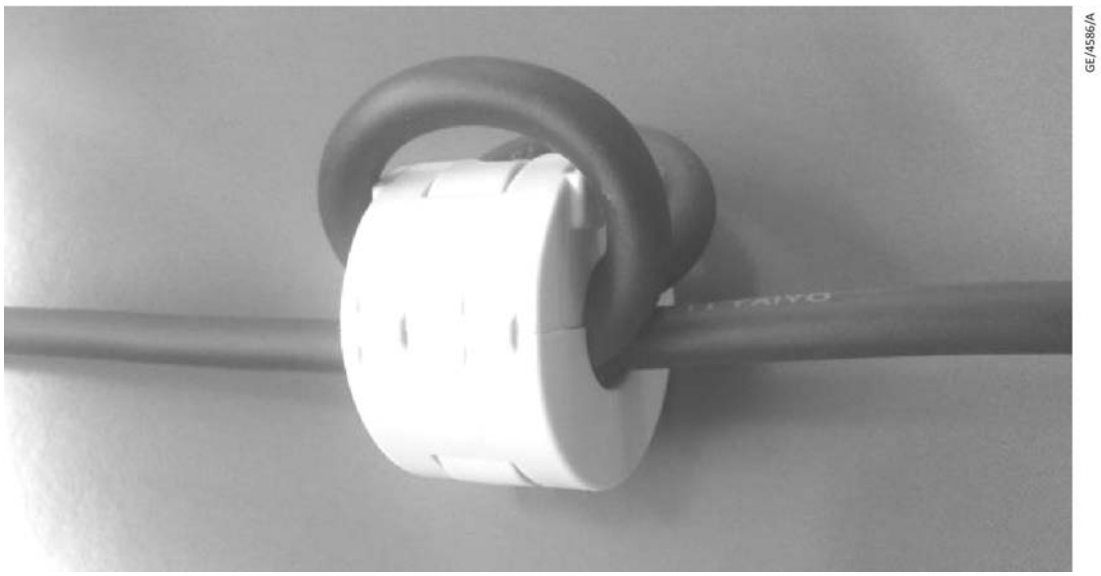
- Ground the communication cable shield by single point to the PC side.
- Do not ground on pump side.
- When ground potential difference is high, the single point grounding may be more effective than both ends grounding against a noise.

Figure 5 Grounding example (single point grounding)



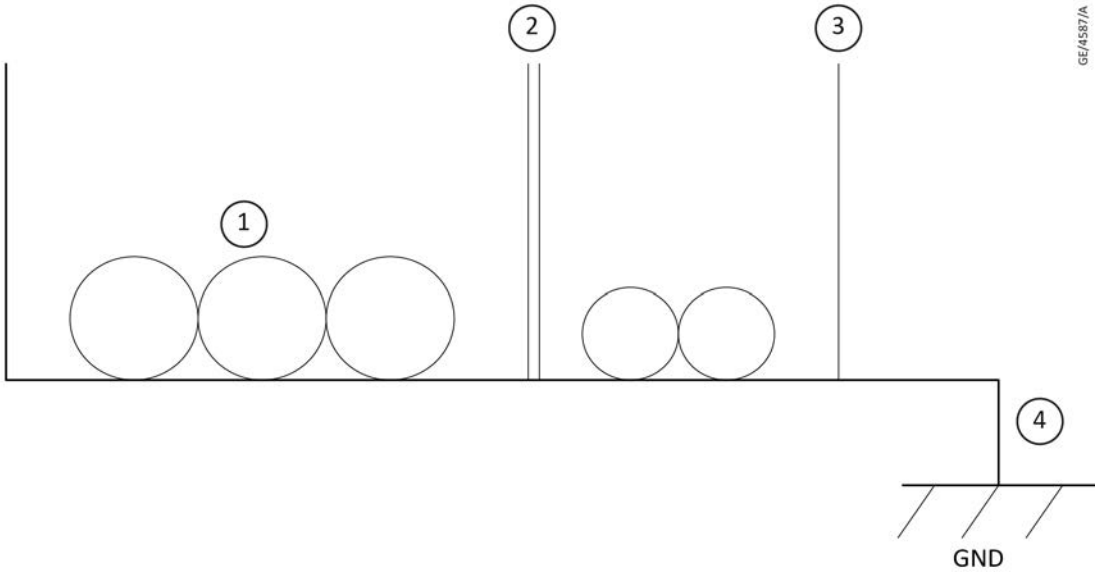
- Do not bundle a communication line with a protective earth conductor or a power line.
  Keep away a communication line from the apparatus used as a noise source.
- As radio frequency noise measure, place a ferrite core on both ends of the communication cable.
  If electromagnetic interference caused by radio frequency noise is in frequency band (150 kHz to 1 GHz) it affects communication, attaching ring ferrite cores to the cable is effective to reduce communication failure.

Figure 6 Example of ring ferrite core installation



- Locate and secure the cables.
  It may be difficult to measure the reproducibility of the communication failure without securing the cables.
- Avoid installing a power line and a communication line in the same metallic duct.
  When unavoidable, separate a line with a metal separator and connect the duct containing a metal separator to GND or install a communication line putting it into conductive pipes, such as metal.

Figure 7 Example of cable installation in metallic duct



1. *Power line*
2. *Metallic separator*
3. *Metallic duct*
4. *Communication line*

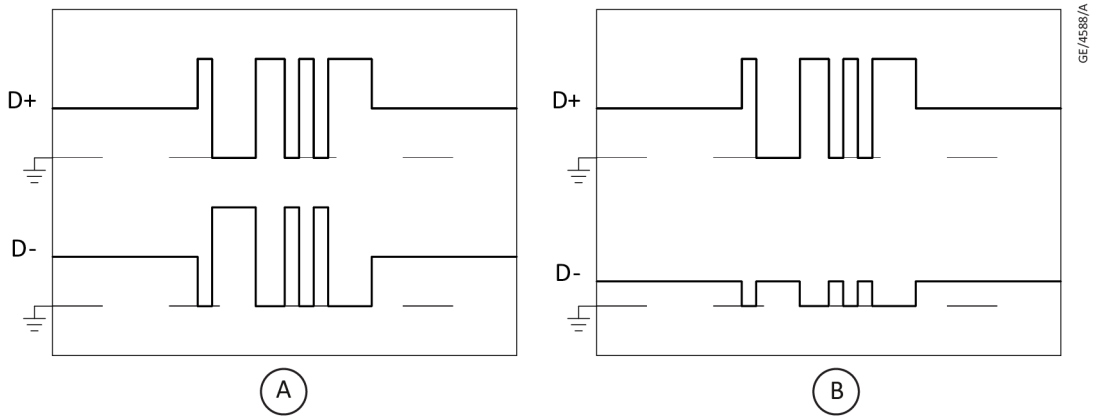
- Do not insert or remove a communication cable while the power of a communication device and a pump are turned ON.

  Communication interface circuit may break down if surge voltage caused by such as potential difference of communication interfaces or static electricity is applied to communication line.

  Communication failure occurs frequently by broken communication interface circuit.

  RS485 is available with communication interface circuit according to the environment, but it gets the failure easily. Check if the waveform of the differential signal is normal with measuring instruments, such as an oscilloscope.

Figure 8 Example of differential signal waveform



A. *Normal*

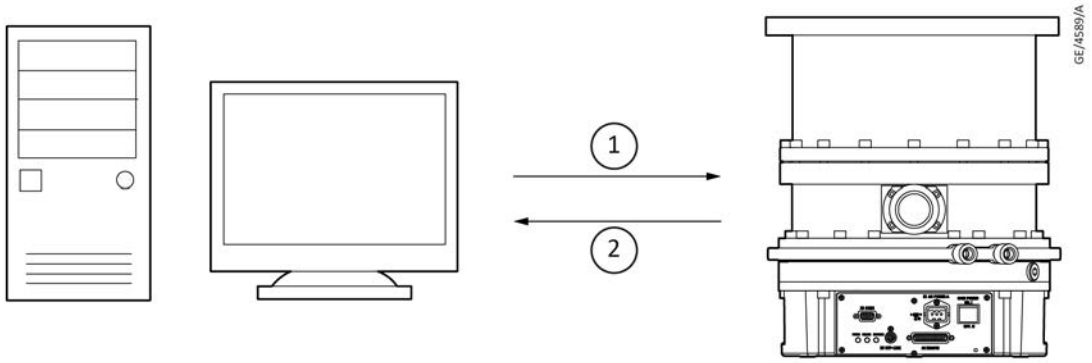
B. *Abnormal (abnormal voltage amplitude)*

4. Protocol specifications

4.1 General description

The serial communication protocol enables the SIM to receive the communication command transmitted from the PC and sends a response following the communication command (refer to *Figure: PC to SIM communication*). Each communication command from the PC transmits a text message (ASCII text) assigned to each function (refer to *Figure: PC to SIM communication*). Communication commands include control commands (pump operation commands, etc.) and query commands (read-out of pump operation mode, etc.).

Figure 9 PC to SIM communication



1. *Communication command*
2. *Response*

Table: Transmission control characters shows ASCII characters being used in the transmission control, error control and handshake in the application layer.

Table 5 Transmission control characters

Layer	ASCII character	HEX code	Function
Transmission layer	Stx	02	Transmission block start character
	Etx	03	Transmission frame end character
	Etb	17	Transmission block end character
	Ack	06	Acknowledgement response
	Nak	15	Non-acknowledgement response
	@	40	Network frame ID character
Application layer	#	23	Acknowledgement response
	!	21	Non-acknowledgement response

4.2 Standard transmission frame (in the RS232 or RS485 single point connection)

The transmission frame has a single block or multiple transmission blocks. The transmission block consists of a start control character, data block number (3 digits),

a message (up to 255 characters), an end control character and a checksum (LRC). The following table shows the transmission frame where the message transmission character string is C_n.

Transmission frame when a message is below 255 characters (n<=255):

	1	2	3	4	5	...	5+n	5+n+1	5+n+2
ASCII	Stx	0	0	1	$C1_1$	...	C_n	Etx	LRC

"Stx" and "Etx" are used as a start and an end character of the transmission frame, respectively.

Transmission frame when a message exceeds 255 characters (n = 255, m<=255, k = the number of transmission blocks):

First		1	2	3	4	5	...	5+n	5+n+1	5+n+2
Block	ASCII	Stx	0	0	1	$C1_1$	...	$C1_n$	Etb	LRC

Second		1	2	3	4	5	...	5+n	5+n+1	5+n+2
Block	ASCII	Stx	0	0	2	$C2_1$	...	$C2_n$	Etb	LRC

Final		1	2	3	4	5	...	5+m	5+m+1	5+m+2
Block	ASCII	Stx	k			Ck_1	...	Ck_m	Etx	LRC

"Stx" is used as a start character of each transmission block. "Etb" is used as an end character of the transmission block with a message of 255 characters. "Etx" is used as an end character of the final transmission block (the end character of the transmission frame).

4.3 Control command (in the RS232/RS485 single point connection)

A control command is used when transmitting a pump operation commands and a setting change commands to the SIM. The first character of the control command is "Sp" (a space character, HEX code "20") and succeeding characters are ASCII characters corresponding to the respective function code and parameter.

Sp	CHR	C_1	C_2		...	...		C_n

CHR: Function code character

C_1 to C_n: Parameter.

Parameter (from C_1 to C_n) serves as 16 bits signed hexadecimal value coded ASCII text. When a message (a space character, a function code and parameter) exceeds 255 characters, input "Sp" and CHR to the top transmission block only (the first transmission block of the transmission frame). It is not necessary to input them to the second and succeeding transmission blocks.

The SIM returns the acknowledgement response character "#" when the control command is processed normally. If not, the SIM returns the non-acknowledgement

response character "!" and 3 characters of the non-acknowledgement code are added to "!".

Transmission frame when data is transmitted to one block (a message is less than 256 characters):

Designate the control command on the PC.

<- Less than 256 chr. ->

PC->SIM	Stx	0	0	1	Sp	CHR	C_1	...	C_n	Etx	LRC	
SIM->PC												Ack or Nak

Always assign less than 254 characters (n< 254) to the parameter so that the message is less than 256 characters.

Then the preceding SIM->PC character is "Ack", the instructed control command is executed and the SIM returns the following response.

PC->SIM							Ack or Nak
SIM->PC	Stx	0	0	1	# or !	Etx	LRC

The PC transmits "Ack" or "Nak"; then transmits the next command if necessary.

Transmission frame when data is transmitted to two blocks (message is more than 256 characters and less than 512 characters):

Designate the control command (the 1st block) on the PC

PC->SIM	Stx	0	0	1	Sp	CHR	C_1	...	C_{253}	Etb	LRC	
SIM->PC												Ack or Nak

Next, the preceding SIM->PC character is "Ack", the PC continues instructing the control command (the 2nd block).

PC->SIM	Stx	0	0	2	C_{254}	...	Cn	Etx	LRC	
SIM->PC										Ack or Nak

Always assign less than 510 characters (n< 510) to the parameter so that the message is less than 512 characters.

Then the preceding SIM->PC character is "Ack", the instructed control command is executed and the SIM returns the following response.

PC->SIM							Ack or Nak
SIM->PC	Stx	0	0	1	# or !	Etx	LRC

The PC transmits "Ack" or "Nak"; then transmits the next command if necessary.

4.4 Query command (in the RS232/RS485 single point connection)

A query command is used to read the pump operation state and setting values. The first character of the query command in the RS232 or RS485 single point connection is

"?"(HEX code "3F") and succeeding characters are ASCII characters corresponding to the respective function code and parameter.

?	CHR	C_1	C_2		...	...		C_n

CHR: Function code character

C_1 to C_n: Parameter

Parameter (from C_1 to C_n) serves as 16 bits signed hexadecimal value coded ASCII text. When a message (a space character, a function code and parameter) exceeds 255 characters, input "?" and CHR to the top transmission block only (the first transmission block of the transmission frame). It is not necessary to input them to the second and succeeding transmission blocks.

The SIM returns the acknowledgement response character "#" when the query command is processed normally. If not, the SIM returns the non-acknowledgement response character "!" and 3 characters of the non-acknowledgement code are added to "!".

Transmission frame when data is transmitted at one block and returned at two blocks:

Designate a query command on the PC

<- Less than 256 chr. ->

PC->SIM	Stx	0	0	1	?	CHR	C_1	...	C_n	Etx	LRC	
SIM->PC												Ack or Nak

Always assign less than 254 characters (n< 254) to the parameter so that the message is less than 256 characters.

Next, the preceding SIM->PC character is "Ack", the instructed query command is executed and the SIM returns the following response (1st block).

PC->SIM												Ack or Nak
SIM->PC	Stx	0	0	1	Sp	CHR	C_1	...	C_{253}	Etb	LRC	

Then "Ack" is sent by the PC->SIM character in reaction to the response (1st block) from the SIM, the SIM returns the following response (2nd block).

PC->SIM										Ack or Nak
SIM->PC	Stx	0	0	2	C_{254}	...	C_n	Etx	LRC	

The PC transmits "Ack" or "Nak"; then transmits the next command if necessary.

4.5 Transmission data format

Data value is 16 bits signed hexadecimal value coded ASCII text.

Example: 12090 on a decimal basis equals to 2F3A on a hexadecimal basis.

4.6 Frame control (checksum)

The transmission frame is controlled by the odd number parity check. First initialize LRC as FF_{hex}. Next calculate LRC by EXCLUSIVE-OR (XOR) of all the frame bytes containing "Stx", "Etb", "Etx" and LRC and transmit the result as LRC.

Examples:

Character string for calculation before calculating LRC:

ASCII	Stx	0	0	1	#	Etx	LRC
HEX	02	30	30	31	23	03	FF

Calculation of LRC:

02_{hex} XOR 30_{hex} XOR 30_{hex} XOR 31_{hex} XOR 23_{hex} XOR 03_{hex} XOR FF_{hex} = EC_{hex}

Character string for transmission after calculating LRC:

ASCII	Stx	0	0	1	#	Etx	LRC
HEX	02	30	30	31	23	03	EC

However, the MSB (most significant bit) is always 0 when data length is 7 bits, LRC is set to $6C_{hex}$.

4.7 Error control

- Transmit the transmission frame repeatedly from the PC when the SIM transmits "Nak" (parity check error). When the SIM receives "Nak" from the PC, the transmission frame is transmitted again. This operation is repeated up to 5 times.
- The SIM transmits "Ack" or "Nak" to the PC after the completion of communication command reception. When the PC cannot receive "Ack" or "NaK" after 2 second, retransmit the transmission frame from the PC.

When these communication status occur repeatedly, display to an error message or start the error routine on the PC.

4.8 Transmission frame in the RS485 multi-point connection

To identify a network frame and ensure the compatibility with a standard transmission frame, add a network frame ID character "@" and a title of 3 characters of network frame number to the transmission frame in the RS485 multi-point connection.

The network frame number is specified by any 16 bits signed hexadecimal value coded ASCII text of 1 to 127, to identify the SIM.

Examples: Network frame ID character and number in the multi-point connection

ASCII	@	0	1
HEX	40	30	31

Network frame No "1"

ASCII	@	6	4
HEX	40	36	34

Network frame No "100"

ASCII	@	7	F
HEX	40	37	46

Network frame No "127"

The transmission frame has a single block or multiple transmission blocks. Each transmission block consists of a network frame ID character, a network frame number, a

start control character, data block number (3 digits), a message (up to 255 characters), an end control character and a checksum (LRC). The following shows the transmission frame when the message transmission character string is C_n.

Transmission frame when a message is below 255 characters (n<=255):

	1	2	3	4	5	6	7	8	...	8+n	8+n+1	8+n+2
ASCII	@	F_1	F_2	Stx	0	0	1	C_1	...	C_n	Etx	LRC

"@" is used as a network frame ID character.

"Stx" and "Etx" are used as a start and an end character of the transmission frame, respectively.

Transmission frame when a message exceeds 255 characters (n = 255, m<=255, k = the number of transmission blocks)

		1	2	3	4	5	6	7	8	...	8+n	8+n+1	8+n+2
First Block	ASCII	@	F_1	F_2	Stx	0	0	1	$C1_1$	...	$C1_n$	Etb	LRC
Second Block	ASCII	@	F_1	F_2	Stx	0	0	2	$C2_1$	...	$C2_n$	Etb	LRC
Final Block	ASCII	@	F_1	F2	Stx	k			Ck_1	...	Ck_m	Etx	LRC

"@" is used as a network frame ID character.

"Stx" is a start character of each transmission block and "Etb" is an end character of the transmission block of a message of 255 characters.

"Etx" is used as an end character of the final transmission block (end character of the transmission frame).

4.9 Control command in the RS485 multi-point connection

The control command must be used when a pump operation instruction or a setting change instruction is transmitted to the SIM and is arranged in the order specified below. The top is "Sp" (space character, HEX code "20") and ASCII characters corresponding to the respective function code and parameter follow.

Sp	CHR	C_1	C_2		...	...		C_n

CHR: Function code character, C_1 to C_n: Parameter

Parameter (from C_1 to C_n) serves as 16 bits signed hexadecimal value coded ASCII text. When a message (a space character, a function code, and parameter) exceeds 255 characters, input "Sp" and CHR to the top transmission block only (the first transmission block of the transmission frame). It is not necessary to input them to the second and succeeding transmission blocks.

The SIM returns the acknowledgement response character "#" when the control command is processed normally. If not, the SIM returns the non-acknowledgement response character "!" and 3 characters of the non-acknowledgement code are added to "!".

Transmission frame when data is transmitted to one block (a message is less than 256 characters):

Designate the control command on the PC.

<- Less than 256 chr.->

PC->SIM	@	F_1	F_2	Stx	0	0	1	Sp	CHR	C_1	...	C_n	Etx	LRC
SIM->PC														

Ack or Nak	F_1	F_2

Always assign less than 254 characters (n< 254) to the parameter so that the message is less than 256 characters.

Next, the preceding SIM->PC character is "Ack", the instructed control command is executed and the SIM returns the following response.

PC->SIM									Ack or Nak	F_1	F_2
SIM->PC	@	F_1	F_2	Stx	0	0	1	# or !	Etx	LRC

The PC transmits "Ack" or "Nak"; then transmits the next command if necessary.

Transmission frame when data is transmitted to two blocks (message is more than 256 characters and less than 512 characters):

Designate the control command (the 1st block) on the PC.

PC->SIM	@	F_1	F_2	Stx	0	0	1	Sp	CHR	C_1	...	C_{253}	Etb	LRC
SIM->PC														

Ack or Nak	F_1	F_2

Next, the preceding SIM->PC character is "Ack", the PC continues instructing the control command (the 2nd block).

PC->SIM	@	F_1	F_2	Stx	0	0	2	C_{254}	...	C_n	Etx	LRC	
SIM->PC													

Ack or Nak	F_1	F_2

Always assign less than 510 characters (n< 510) to the parameter so that the message is less than 512 characters.

Then the preceding SIM->PC character is "Ack", the instructed control command is executed and the SIM returns the following response.

PC->SIM									Ack or Nak	F_1	F_2
SIM->PC	@	F_1	F_2	Stx	0	0	1	# or !	Etx	LRC

The PC transmits "Ack" or "Nak"; then transmits the next command if necessary.

4.10 Query command in the RS485 multi-point connection

The query command must be used when a pump operation instruction or a setting change instruction is transmitted from the SIM and is arranged in the order specified below. The top is "?" (HEX code "3F") and ASCII characters corresponding to the respective function code and parameter follow.

?	CHR	C_1	C_2		...	...		C_n

CHR: Function code character

C_1 to C_n: Parameter.

Parameter (from C_1 to C_n) serves as 16 bits signed hexadecimal value coded ASCII text. When a message (a space character, a function code and parameter) exceeds 255 characters, input "?" and CHR to the top transmission block only (the first transmission block of the transmission frame). It is not necessary to input them to the second and succeeding transmission blocks.

The SIM returns the acknowledgement response character "#" when the query command is processed normally. If not, the SIM returns the non-acknowledgement response character "!" and 3 characters of the non-acknowledgement code are added to "!".

Transmission frame when data is transmitted from one block and returned to two blocks.

Designate a query command on the PC.

<- Less than 256 chr.->

PC->SIM	@	F_1	F_2	Stx	0	0	1	?	CHR	C_1	...	C_n	Etx	LRC
SIM->PC														

Ack or Nak	F_1	F_2

Always assign less than 254 characters (n< 254) to the parameter so that the message is less than 256 characters.

Next, the preceding SIM->PC character is "Ack", the instructed query command is executed and the SIM returns the following response (1st block).

PC->SIM														
SIM->PC	@	F_1	F_2	Stx	0	0	1	Sp	CHR	C_1	...	C_{253}	Etb	LRC

Ack or Nak	F_1	F_2

Then "Ack" is sent by the PC->SIM character in reaction to the response (1st block) from the SIM, the SIM returns the following response (2nd block).

PC->SIM													
SIM->PC	@	F_1	F_2	Stx	0	0	2	C_{254}	...	C_n	Etx	LRC

Ack or Nak	F_1	F_2

The PC transmits "Ack" or "Nak", then transmits the next command if necessary.

4.11 Broadcasting command in the RS485 multi-point connection

The START or STOP of pump operation command can be concurrently instructed to all the multi-connected SIMs. Always assign 0 (HEX code "30") to network frame number. Note that there is no response from the respective SIM.

PC->SIM	@	0	0	Stx	0	0	1	Sp	E	Parameter 1	Etx	LRC
SIM->PC	No response											

Parameter	Item	Data format	Remark
1	Pump operation command	8-bits hexadecimal coded ASCII	Refer to *Table: Pump operation commands*

Table 6 Pump operation commands

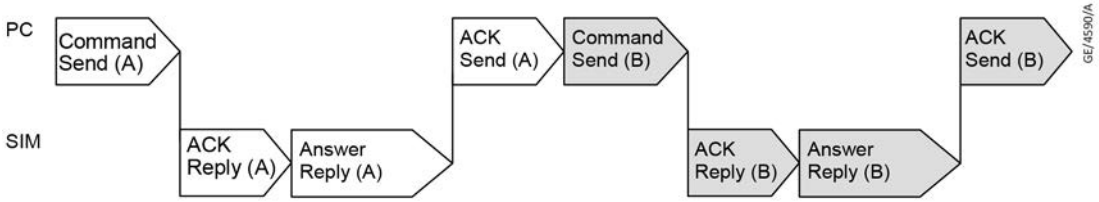
Pump operation command	Value
START	1
STOP	2

4.12 Application note

Noise is generated by many factors such as the type or length of cable or communication speed. Different communication devices may cause the communication failure with a serial port. It is very difficult to prevent a communication failure completely. The followings are the methods to create the tool application with redundancy to a noise etc.

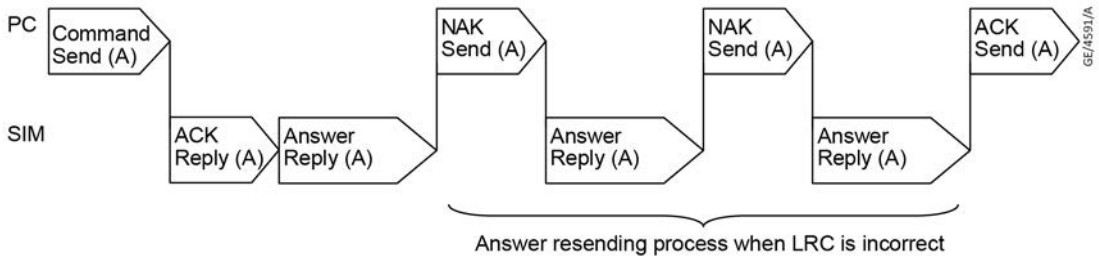
- Make sure to communicate according to the protocol. If it communicates by a different method from the procedure described in this manual, communication failure might occur.
  Figure: Block diagram of communication process example shows the block diagram of the valid communication process from command sending to receiving answer data.
  Moreover, the example of a communication procedure is shown in *Figure: Example of communication cycle process*, *Figure: Example of sending command process* and *Figure: Example of receiving answer process*.

Figure 10 Block diagram of communication process example



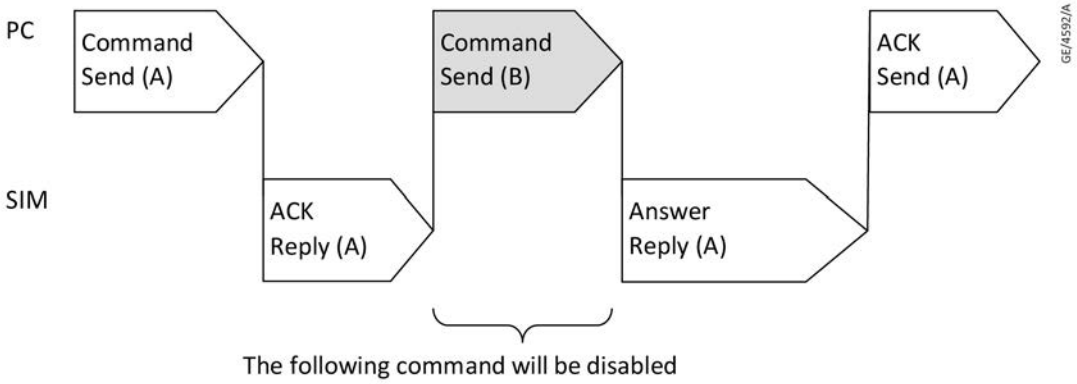
- The SIM will reply "ACK" or "NAK" within approximately 2 seconds after receiving command.
  When there is no reply, the SIM may not have received the command. In this case, resend the command from the tool application before recognizing the process of the communication failure. If the problem is not solved after resending several times, make the process of the communication failure on tool application.
- SIM discards the data received after 5 seconds and the data gets elapsed without completing the command from the command receive start.
  Send a command from tool application again.
- A finish of the received data must be monitored with received character "Etx". Receiving process is completed by receiving the "LRC" (checksum) data after getting "Etx".
  This process can reduce the task of modifying the tool application when commands with different answer data size according to the pump model are received. However, the completion of the answer receiving process is determined by the number of received characters, check that "Etx" has been received and LRC checksum is correct.
- After sending the command, release the elapsed time process due to communication timeout each time when receiving answer data. When a large number of answer data is received, the answer receiving process of the tool application is timed out and all data may not be able to obtain.
- Always check the LRC checksum of answer data. When LRC checksum is incorrect, do not use the data. When the incorrect data caused by noise is accepted, parameters might be set unexpected values. In this case, the processing of the tool application may determine a communication failure. When LRC checksum is incorrect, receive the answer data again according to the following methods.
  - Send "NAK" within 1500 msec after receiving the answer data, and then receive the answer data again from SIM. However, when using RS485, send "NAK" at least 1 msec after receiving the answer data.
  - Stop the communication process and try the communication process again.

Figure 11 Example of resending answer process



- When sending the following command after receiving the answer data from the SIM, the command as shown in *Figure: Example of response when the command is sent continuously* will be disabled.

Figure 12 Example of response when the command is sent continuously



In addition, when using RS485, do not send commands while the answer data is sent from the SIM. The crosstalk of sending data and receiving data will occur and it causes communication failure such as a flaming error.

Figure 13 Example of sending command during answer data reply

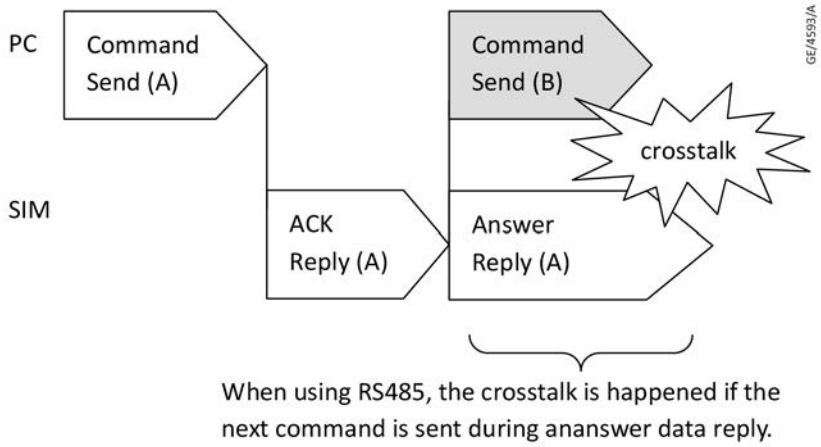


Figure 14 Example of communication cycle process

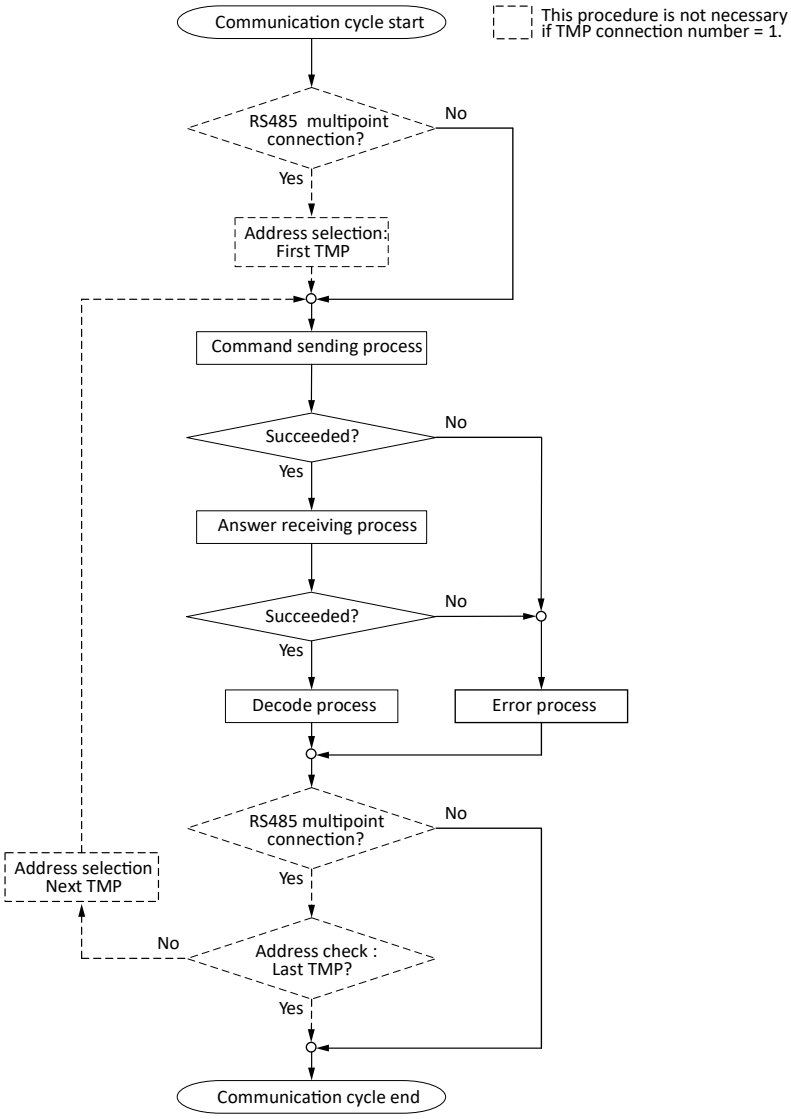


Figure 15 Example of sending command process

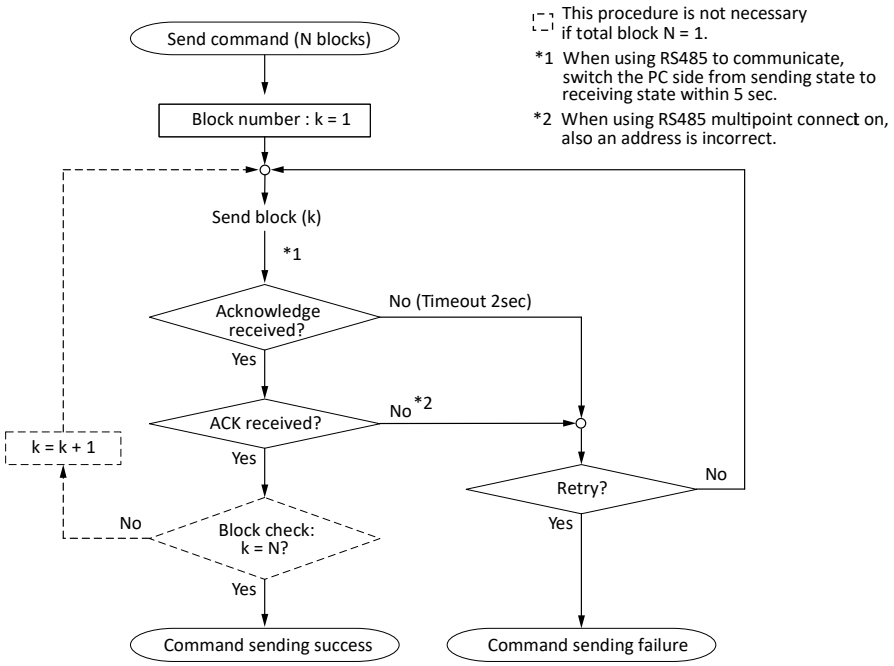
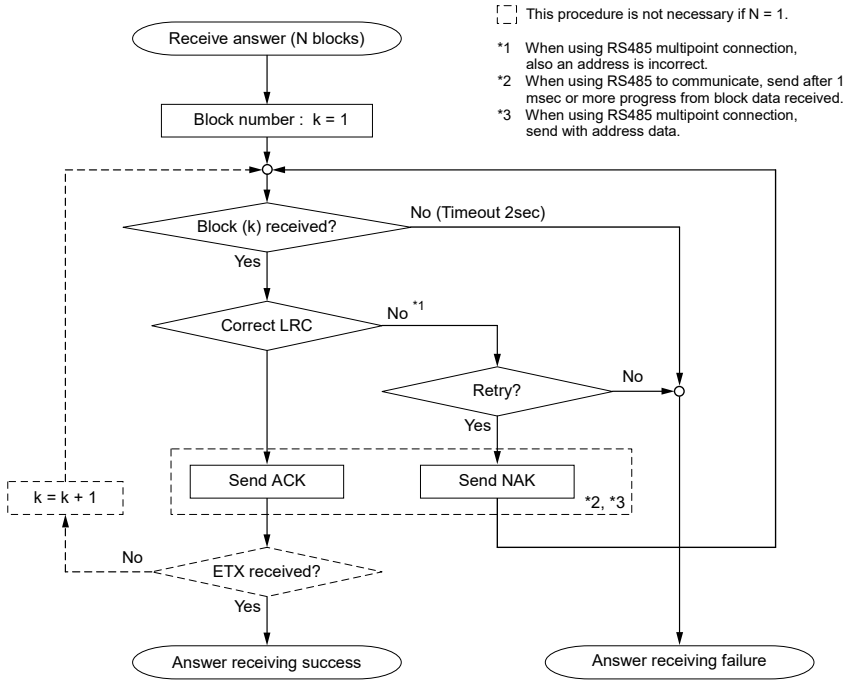


Figure 16 Example of receiving answer process



5. Command specifications

5.1 Command list

Table 7 Command list

Function code		Command/Query name	Function
?	D	ReadMeas	Reads the measured rotational speed.
Sp	E	Command	Sends commands START, STOP, RESET (These commands are valid only when being sent to the serial port which is set as the input operation port.)
?	F	ReadFailMess	Reads the errors being detected.
?	M	ReadModFonct	Reads the pump operation mode and the errors being detected.
?	V	ReadVersion	Reads the software version.
?	c	ReadCounters	Reads serial number, running time and start counter.
?	d	ReadSetPoint	Reads the setting values of the speed set point and the TMS temperature.
?	e	ReadMotorTemp	Reads the measured motor temperature.
?	f	ReadStatus	Reads the various settings. (Remote mode, TMS function and emergency vent valve).
?	g	ReadEvents	Reads the error record.
Sp	h	SetSpeedSetPoint	Changes the speed set point.*1
?	h	ReadSpeedSetPoint	Reads the speed set point.
?	m	ReadModFonctWithWarning	Reads the pump operation mode, the errors and the warnings being detected
?	[	ReadMeasValue	Reads the TMS temperature, motor temperature, motor current, measured rotational speed, and control unit temperature.
?	=	ReadOptionFunc	Reads each setting value of items
Sp	=	SetOptionFunc	Changes each setting value of items *1
?	{	ReadCondition	Reads pump model and damage point
?	}	ReadEventsWithTime	Reads the error record with detection time
Sp	0	SetOptions	Changes optional function (Second speed option)*1
?	0	ReadOptions	Reads optional function (Second speed option)

**1 - There is an endurance limit of setting changes (do not change more than 24 times per day for about ten years). If this limit is exceeded, it may become impossible to change the setting and can also cause pump failure. Do not make setting changes in excess of this endurance limit.*

5.2 ReadMeas

Function: Reads the measured rotational speed.

Transmission frame:

PC->SIM	Stx	0	0	1	?	D	Etx	LRC
SIM->PC								Ack

PC->SIM									Ack
SIM->PC	Stx	0	0	1	Sp	D	Parameter 1 to 2	Etx	LRC

Parameter	Item	Data format	Remarks
1	[System reservation]	56-bits hexadecimal coded ASCII	
2	Measured rotational speed (Unit: Hz)	16-bits hexadecimal coded ASCII	

Example:

Measured rotational speed: $01C2_{hex}$ = 450 Hz = 27,000 rpm

Parameter	1														2			
ASCII	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	0	1	C	2
HEX															30	31	43	32

**1 - System reservation*

5.3 Command

Function: Sends the pump operation commands START, STOP and RESET. These commands are valid only when being sent to the serial port which is set as the input operation port. Refer to *SetOptionFunc* on page 50 for the setting method of the input operation port.

Transmission frame:

PC->SIM	Stx	0	0	1	Sp	E	Parameter 1	Etx	LRC
SIM->PC									Ack
PC->SIM									Ack
SIM->PC	Stx	0	0	1	#	Etx	LRC		

Parameter	Item	Data format	Remark
1	Pump operation command	8-bits hexadecimal coded ASCII	Refer to *Table: Pump operation commands*

Table 8 Pump operation commands

Pump operation command	Value
START	1
STOP	2
RESET	4

Example:

Pump operation command: RESET operation = 4 = 04_{hex}

Parameter	1	
ASCII	0	4
HEX	30	34

5.4 ReadFailMess

Function: Reads the errors being detected. This data is the same data as that of "ReadModFonct" parameter 2 to 81.

Transmission frame:

PC->SIM	Stx	0	0	1	?	F	Etx	LRC
SIM->PC								Ack

PC->SIM									Ack
SIM->PC	Stx	0	0	1	Sp	F	Parameter 1 to 81*1	Etx	LRC

Parameter	Item	Data format	Remarks
1	The number of error	8-bits hexadecimal coded ASCII	Up to 80 errors *1
2 to 81 *1	Error 1	8-bits hexadecimal coded ASCII	*2
	...	...	
	Error 80 *1	8-bits hexadecimal coded ASCII	

**1 - The maximum number of errors may differ depending upon the software version of the pump. It is recommended that an application must be designed as variable-length data.*

**2 - Value corresponding to the error message is transmitted, (refer to Table: Error message values). The most recent error has the largest parameter number. When the number of errors being detected is under the maximum number, the value of parameter that is larger than the number of errors being detected is set to 0.*

Example:

The number of error	02_{hex} = 2 errors
Error 1	$0D_{hex}$ = 13 = Disturbance Xh
Error 2	$0F_{hex}$ = 15 = Disturbance Xb
Error 3 to 80	00_{hex} = No error detected

Parameter	**1**		**2**		**3**		**4**		**5**		**6**		**7**		**8**		**9**		**10**	
ASCII	0	2	0	D	0	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HEX	30	32	30	44	30	46	30	30	30	30	30	30	30	30	30	30	30	30	30	30

Parameter	**11**		**12**		**13**			**68**		**69**		**70**		**71**		**72**		**73**	
ASCII	0	0	0	0	0	0	Omitted	0	0	0	0	0	0	0	0	0	0	0	0
HEX	30	30	30	30	30	30		30	30	30	30	30	30	30	30	30	30	30	30

Parameter	**74**		**75**		**76**		**77**		**78**		**79**		**80**		**81**	
ASCII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HEX	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30

Table 9 Error message values

Error message	**Value**
[System reservation]	0
[System reservation]	1
[System reservation]	2
[System reservation]	3
[System reservation]	4
Power Failure	5
Power Supply Fail	6
Overspeed 1	7
DRV Overvoltage	8
[System reservation]	9
CNT Overheat 1	10
DRV Overcurrent	11
DRV Overload	12
Disturbance X_H	13
Disturbance Y_H	14
Disturbance X_B	15
Disturbance Y_B	16

Error message	Value
Disturbance Z	17
MOTOR Overheat	18
[System reservation]	19
CNT Overheat 2	20
[System reservation]	21
[System reservation]	22
[System reservation]	23
DRV Com. Failure	24
WARNING: 1st Damage Limit	25 *1
WARNING: 2nd Damage Limit	26 *1
START NOT ALLOWED	27
Speed Pulse Lost	28
Overspeed 2	29
Overspeed 3	30
M_Temp Lost	31
[System reservation]	32
AMB Com. Failure	33
[System reservation]	34
[System reservation]	35
[System reservation]	36
[System reservation]	37
[System reservation]	38
[System reservation]	39
[System reservation]	40
[System reservation]	41
[System reservation]	42
WARNING: Imbalance X_H	43 *1
WARNING: Imbalance X_B	44 *1
WARNING: Imbalance Z	45 *1
[System reservation]	46
[System reservation]	47
[System reservation]	48
[System reservation]	49
DRV Failure	50
[System reservation]	51
[System reservation]	52
[System reservation]	53
[System reservation]	54
[System reservation]	55

Error message	Value
[System reservation]	56
[System reservation]	57
[System reservation]	58
Acc Malfunction	59
[System reservation]	60
[System reservation]	61
[System reservation]	62
[System reservation]	63
[System reservation]	64
[System reservation]	65
[System reservation]	66
[System reservation]	67
[System reservation]	68
[System reservation]	69
[System reservation]	70
[System reservation]	71
Aberrant Brake	72
Aberrant Accel	73
[System reservation]	74
[System reservation]	75
Inordinate Current	76
[System reservation]	77
Serial Com. Fail	78 *2
[System reservation]	79
[System reservation]	80
[System reservation]	81
[System reservation]	82
[System reservation]	83
[System reservation]	84
[System reservation]	85
[System reservation]	86
[System reservation]	87
Overspeed 4	88
[System reservation]	89
[System reservation]	90
WARNING: Pump Run Time Over	91 *1
WARNING: Pump Overload	92 *1
[System reservation]	93

Error message	Value
Other Warning 1 (C/U Restart)	94 *1
Other Warning 2 (Fan Warning)	95 *1

**1 - CAUTION or WARNING message. It is not a state of failure. Refer to the pump manual. The pump will continue to operate after one of these messages is displayed. It is recommended that an application must be designed considering this.*

**2 - When the setting value of serial communication timeout is 0, the error 78 is disabled (not detected).*

5.5 ReadModFonct

Function: Reads the pump operation mode and the errors being detected. The data of errors being detected reads the same data as that of "ReadFailMess".

Transmission frame:

PC->SIM	Stx	0	0	1	?	M	Etx	LRC
SIM->PC								Ack

PC->SIM									Ack
SIM->PC	Stx	0	0	1	Sp	M	Parameter 1 to 82 *1	Etx	LRC

Parameter	Item	Data format	Remarks
1	Pump operation mode	8-bits hexadecimal coded ASCII	Refer to *Table: Pump operation mode*.
2	The number of error	8-bits hexadecimal coded ASCII	Up to 80 errors *1
3 to 82 *1	Error 1	8-bits hexadecimal coded ASCII	*2
	...	...	
	Error 80 *1	8-bits hexadecimal coded ASCII	

**1 - The maximum number of errors may differ depending upon the software version of the pump. It is recommended that an application be designed as variable-length data.*

**2 - Value corresponding to the error message is transmitted (refer to Table: Error message values). The most recent error has the largest parameter number. When the number of errors being detected is under the maximum number, the value of parameter that is larger than the number of errors being detected is set to 0.*

Table 10 Pump operation mode

Pump operation mode	Value
Levitation	1
No Levitation	2
Acceleration	3
Normal	4
Deceleration (Brake)	5
Autotest	6
[System Reservation]	7
[System Reservation]	8
[System Reservation]	9
[System Reservation]	10
[System Reservation]	11

Example:

Pump operation mode	01_{hex} = 1 = Levitation
The number of error	02_{hex} = 2 errors
Error 1	$0D_{hex}$ = 13 = Disturbance Xh
Error 2	$0F_{hex}$ = 15 = Disturbance Xb
Error 3 to 80	00_{hex} = No error detected

Parameter	1		2		3		4		5		6		7		8		9		10		11	
ASCII	0	1	0	2	0	D	0	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HEX	30	31	30	32	30	44	30	46	30	30	30	30	30	30	30	30	30	30	30	30	30	30

Parameter	12		13			68		69		70		71		72		73		74		75	
ASCII	0	0	0	0	[Omitted]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HEX	30	30	30	30		30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30

Parameter	76		77		78		79		80		81		82	
ASCII	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HEX	30	30	30	30	30	30	30	30	30	30	30	30	30	30

5.6 ReadVersion

Function: Read the software version.

Transmission frame:

PC->SIM	Stx	0	0	1	?	V	Etx	LRC
SIM->PC								Ack

PC->SIM									Ack
SIM->PC	Stx	0	0	1	Sp	V	Parameter 1 to 24	Etx	LRC

Parameter	Item	Data format	Remarks
1 to 16	Control unit software version	8-bits hexadecimal coded ASCII	
17 to 20	Motor driver software version	ASCII character	Ver.1.2 = 0120
21 to 24	AMB software version	ASCII character	Ver.3.4 = 0340

Example:

Control unit software version	38395F4120312E30202020202020202020hex = 89_A 1.0
Motor driver software version	0120_{hex} = 1.2
DSP software version	0340_{hex} = 3.4

Parameter	1		2		3		4		5		6		7		8		9		10	
	"8		"9"		"_"		"A"		" "		"1"		"."		"0"		" "		" "	
ASCII	3	8	3	9	5	F	4	1	2	0	3	1	2	E	3	0	2	0	2	0
HEX	33	38	33	39	35	46	34	31	32	30	33	31	32	45	33	30	32	30	32	30

Parameter	11		12		13		14		15		16		17	18	19	20	21	22	23	24
	" "		" "		" "		" "		" "		" "									
ASCII	2	0	2	0	2	0	2	0	2	0	2	0	0	1	2	0	0	3	4	0
HEX	32	30	32	30	32	30	32	30	32	30	32	30	30	31	32	30	30	33	34	30

5.7 ReadCounters

Function: Reads serial number, running time and start counter.

Transmission frame:

PC->SIM	Stx	0	0	1	?	c	Etx	LRC
SIM->PC								Ack

PC->SIM									Ack
SIM->PC	Stx	0	0	1	Sp	c	Parameter 1 to 23	Etx	LRC

Parameter	Item	Data format	Remarks
1 to 10	Control unit serial number	ASCII character	
11 to 20	Pump serial number	ASCII character	
21	Pump running time (Unit: minute)	32-bits hexadecimal coded ASCII	
22	Control unit running time (Unit: minute)	32-bits hexadecimal coded ASCII	
23	Start counter	32-bits hexadecimal coded ASCII	

Example:

Control unit serial number	12345
Pump serial number	6789A
Pump running time	$0000003C_{hex}$ = 60 minutes = 1 hour
Control unit running time	$0000028C_{hex}$ = 652 minutes =10 hours and 52 minutes
Start counter	00000064_{hex} = 100 times

Parameter	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
ASCII	1	2	3	4	5						6	7	8	9	A					
HEX	31	32	33	34	35	20	20	20	20	20	36	37	38	39	41	20	20	20	20	20

Parameter	21								22								23							
ASCII	0	0	0	0	0	0	3	C	0	0	0	0	0	2	8	C	0	0	0	0	0	0	6	4
HEX	30	30	30	30	30	30	33	43	30	30	30	30	30	32	38	43	30	30	30	30	30	30	36	34

5.8 ReadSetPoint

Function: Reads the setting value of the "Speed Set Point" and TMS temperature. The "Speed Set Point" data is the same data as that of "ReadSpeedSetPoint".

Transmission frame:

PC->SIM	Stx	0	0	1	?	d	Etx	LRC
SIM->PC								Ack

PC->SIM									Ack
SIM->PC	Stx	0	0	1	Sp	d	Parameter 1 to 2	Etx	LRC

Parameter	Item	Data format	Remarks
1	Speed Set Point (Unit: Hz)	16-bits hexadecimal coded ASCII	
2*1	TMS temperature setting (Unit: °C)	16-bits hexadecimal coded ASCII	

**1 - Valid only with TMS specification.*

Example:

Speed Set Point	$01F4_{hex}$ = 500 Hz = 30,000 rpm
TMS temperature setting	0046_{hex} = 70 °C

Parameter	1				2			
ASCII	0	1	F	4	0	0	4	6
HEX	30	31	46	34	30	30	34	36

5.9 ReadMotorTemp

Function: Reads the measured motor temperature.

Transmission frame:

PC->SIM	Stx	0	0	1	?	e	Etx	LRC	
SIM->PC									Ack
PC->SIM									Ack
SIM->PC	Stx	0	0	1	Sp	e	Parameter 1	Etx	LRC

Parameter	Item	Data format	Remark
1	Motor temperature (Unit: °C)	16-bits hexadecimal coded ASCII	

Example:

Motor temperature	0014_{hex} = 20 °C (68 °F)°

Parameter	1			
ASCII	0	0	1	4
HEX	30	30	31	34

5.10 ReadStatus

Function: Reads various settings (Remote mode, TMS function, Emergency vent valve).

Transmission frame:

PC->SIM	Stx	0	0	1	?	f	Etx	LRC	
SIM->PC									Ack

PC->SIM									Ack
SIM->PC	Stx	0	0	1	Sp	f	Parameter 1 to 4	Etx	LRC

Parameter	Item	Data format	Remarks
1	Remote mode setting	8-bits hexadecimal coded ASCII	Refer to *Table: Remote mode*.
2*1	TMS function setting	8-bits hexadecimal coded ASCII	00_{hex}: ENABLE Excluding 00_{hex}: DISABLE
3	[System reservation]	8-bits hexadecimal coded ASCII	
4*1	Emergency vent valve setting	8-bits hexadecimal coded ASCII	00_{hex}: ENABLE Excluding 00_{hex}: DISABLE

**1 - Valid only with TMS specification. Do not set "ENABLE" without TMS specification.*

Table 11 Remote mode

Remote mode	Value
I/O Remote (X2)	1
COM1 (X3)	2
COM3 (X5 STP-LINK)	6
[System reservation]	3, 4, 5

Example:

Remote mode setting	01_{hex} = I/O Remote
TMS function setting	00_{hex} = ENABLE
Emergency vent valve setting	FF_{hex} = DISABLE

Parameter	1		2		3		4	
ASCII	0	1	0	0	*1	*1	F	F
HEX	30	31	30	30			46	46

**1 - System reservation*

5.11 ReadEvents

Function: Reads the "Error Record". It has the most recent 10 errors that have been detected.

Transmission frame:

PC->SIM	Stx	0	0	1	?	g	Etx	LRC	
SIM->PC									Ack

PC->SIM										Ack
SIM->PC	Stx	0	0	1	Sp	g	Parameter 1 to 11		Etx	LRC

Parameter	Item	Data format	Remarks
1	The number of "Error Record"	8-bits hexadecimal coded ASCII	Up to 10 errors
2 to 11	Error Record 1 to Error Record 10	8-bits hexadecimal coded ASCII	*1

**1 - Value corresponding to the error message is transmitted (refer to Table: Error message values). The most recent error has the smallest parameter number. When the number of errors being detected is under the maximum number, the value of parameter that is larger than the number of errors has been detected is set to 0.*

Example:

When 3 errors have been detected in the past;

The number of "Error Record"	03_{hex} = 3 errors
Error Record 1	$0F_{hex}$ = 15 = Disturbance Xb
Error Record 2	$0D_{hex}$ = 13 = Disturbance Xh
Error Record 3	12_{hex} = 18 = T.Cable Disconnected
Error Record 4 to 10	00_{hex} = No error recorded

Parame-ter	1		2		3		4		5		6		7		8		9		10		11	
ASCII	0	3	0	F	0	D	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HEX	30	33	30	46	30	44	31	32	30	30	30	30	30	30	30	30	30	30	30	30	30	30

5.12 SetSpeedSetPoint

CAUTION: ENDURANCE LIMIT

Risk of damage to the equipment. There is an endurance limit of setting changes (do not change more than 24 times per day for about ten years). If this limit is exceeded, it may become impossible to change the setting and can also cause pump failure. Do not make setting changes in excess of this endurance limit.

Function: Changes the "Speed Set Point" value. This value can be changed from 18,500 to 36,500 rpm. The threshold value for the illumination pattern of the "ROTATION" LED is fixed. It is not changed even if the setting value of the rotational speed is changed.

Transmission frame:

PC->SIM	Stx	0	0	1	Sp	h	Parameter 1	Etx	LRC
SIM->PC									Ack

PC->SIM							Ack
SIM->PC	Stx	0	0	1	#	Etx	LRC

Parameter	Items	Data format	Remark
1	Speed Set Point (Unit: Hz)	16-bits hexadecimal coded ASCII	*1

**1 - When the value set to the parameter is larger than the upper limit, it is automatically set to the upper limit. When the value set to the parameter is smaller than the lower limit, it is automatically set to the lower limit.*

Example:

Speed Set Point	0190_{hex} = 400 Hz = 24,000 rpm

Parameter	1			
ASCII	0	1	9	0
HEX	30	31	39	30

5.13 ReadSpeedSetPoint

Function: Reads the "Speed Set Point" value. This value is the same as "ReadSetPoint" parameter 1 (Speed Set Point).

Transmission frame:

PC->SIM	Stx	0	0	1	?	h	Etx	LRC
SIM->PC								Ack

PC->SIM									Ack
SIM->PC	Stx	0	0	1	Sp	h	Parameter 1	Etx	LRC

Parameter	Item	Data format	Remark
1	Speed Set Point (Unit: Hz)	16-bits hexadecimal coded ASCII	

Example:

Speed Set Point	$015E_{hex}$ = 350 Hz = 21,000 rpm

Parameter	1			
ASCII	0	1	5	E
HEX	30	31	35	45

5.14 ReadModFonctWithWarning

Function: Reads the pump operation mode, errors and warnings being detected.

Transmission Frame:

PC→SIM	Stx	0	0	1	?	m	Etx	LRC
SIM→PC								Ack

PC→SIM									Ack
SIM→PC	Stx	0	0	1	Sp	m	Parameter 1 to 82*1	Etx	LRC

Parameter	Item	Data format	Remark
1	Pump operation mode	8-bits hexadecimal coded ASCII	Refer to *Table: Pump operation mode*
2	WARNING being detected	16-bits hexadecimal coded ASCII	Refer to *Table: Warning value bit assign*
3	The number of errors detected	8-bits hexadecimal coded ASCII	Up to 80 errors *1

Parameter	Item	Data format	Remark
4 to 83 *1	Error 1	8-bits hexadecimal coded ASCII	*2
	...		
	Error 80 *1	8-bits hexadecimal coded ASCII	

**1 - The maximum number of errors may differ depending upon the software version of the pump. It is recommended that an application be designed as variable-length data.*

**2 - Value corresponding to the error message is transmitted (refer to Table: Error message values).*
The recent error has the largest parameter number. When the number of errors being detected is under the maximum number, the value of parameter that is larger than the number of errors being detected is set to 0.

Table 12 Warning value bit assign

Bit	Warning message	16-bits hex value
0	[System reservation]	0001
1	WARNING: Second Damage Limit	0002
2	WARNING: First Damage Limit	0004
3	WARNING: Imbalance X_H	0008
4	WARNING: Imbalance X_B	0010
5	WARNING: Imbalance Z	0020
6	WARNING: Pump Run Time Over	0040
7	WARNING: Pump Overload	0080
8	[System reservation]	0100
9	[System reservation]	0200
10	[System reservation]	0400
11	[System reservation]	0800
12	[System reservation]	1000
13	[System reservation]	2000
14	WARNING: Other Warning *1	4000
15	[System reservation]	8000

**1 - FAN Warning or C/U Restart*

Example:

Pump operation mode	01_{hex} = 1 = Levitation
WARNING being detected	000C $_{hex}$ = 0004_{hex} OR 0080_{hex} = "WARNING: First Damage Limit" and "WARNING: Imbalance X_H"
The number of error	02_{hex} = 2 errors

Error 1	$0D_{hex}$ = 13 = Disturbance Xh
Error 2	$0F_{hex}$ = 15 = Disturbance Xb
Error 3 to 79	00_{hex} = No error detected

Parameter	**1**		**2**				**3**		**4**		**5**		**6**		**7**		**8**		**9**		**10**	
ASCII	0	1	0	0	0	C	0	2	0	D	0	F	0	0	0	0	0	0	0	0	0	0
HEX	30	31	30	30	30	43	30	32	30	44	30	46	30	30	30	30	30	30	30	30	30	30

Parameter	**11**		**12**		**13**		**14**		**15**			**70**		**71**		**72**		**73**		**74**	
ASCII	0	0	0	0	0	0	0	0	0	0	[Omitted]	0	0	0	0	0	0	0	0	0	0
HEX	30	30	30	30	30	30	30	30	30	30		30	30	30	30	30	30	30	30	30	30

Parameter	**75**		**76**		**77**		**78**		**79**		**80**		**81**		**82**	
ASCII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HEX	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30

5.15 ReadMeasValue

Function: Reads the TMS temperature, motor temperature, motor current, measured rotational speed, and control unit temperature. The motor temperature value is the same temperature as "ReadMotorTemp". The measured rotational speed value is the same as "ReadMeas" parameter 2 (Measured rotational speed).

Transmission frame:

					*1			
PC->SIM	Stx	0	0	1	?	[	Etx	LRC
SIM->PC								Ack

PC->SIM					*1				Ack
SIM->PC	Stx	0	0	1	Sp	[	Parameter 1 to 9	Etx	LRC

**1 - The HEX code of ASCII character '[' is "5B".*

Parameter	Item	Data format	Remark
1	[System reservation]	120-bits hexadecimal coded ASCII	
2*1	TMS temperature (Unit °C)	16-bits hexadecimal coded ASCII	

Parameter	Item	Data format	Remark
3	Motor temperature (Unit °C)	16-bits hexadecimal coded ASCII	
4	[System reservation]	8-bits hexadecimal coded ASCII	
5	Motor current (Unit: 0.1 A)	8-bits hexadecimal coded ASCII	
6	[System reservation]	24-bits hexadecimal coded ASCII	
7	Measured rotational speed (Unit: Hz)	16-bits hexadecimal coded ASCII	
8	[System reservation]	48-bits hexadecimal coded ASCII	
9	Control unit temperature (Unit: °C)	16-bits hexadecimal coded ASCII	

**1 - Valid only with TMS specification*

Example:

TMS temperature	0046_{hex} = 70 °C (158 °F)
Motor temperature	$0014C_{hex}$ = 20 °C (68 °F)
Motor current	19_{hex} = 2.5 A
Measured rotational speed	$01C2_{hex}$ = 450 Hz = 27,000 rpm
Control unit temperature	0032_{hex} = 50 °C

Parameter	**1**																	
ASCII	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1
HEX																		

Parameter	**1**												**2**			
ASCII	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	0	0	4	6
HEX													30	30	34	36

Parameter	**3**				**4**		**5**		**6**						**7**			
ASCII	0	0	1	4	*1	*1	1	9	*1	*1	*1	*1	*1	*1	0	1	C	2
HEX	30	30	31	34			31	39							30	31	43	32

Parameter	8												9			
ASCII	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	0	0	3	2
HEX													30	30	33	32

**1 - System reservation*

5.16 ReadOptionFunc

Function: Reads the setting value of the input operation port, warning function and serial communication time out.

Transmission frame:

					*1			
PC→SIM	Stx	0	0	1	?	=	Etx	LRC
SIM→PC								Ack

					*1				Ack
PC→SIM									
SIM→PC	Stx	0	0	1	Sp	=	Parameter 1 to 13	Etx	LRC

**1 - The HEX code of ASCII character ' = ' is "3D".*

Parameter	Item	Data format	Remarks
1	Input operation port setting	8-bits hexadecimal coded ASCII	
2*1	TMS Option Enable/Disable setting	8-bits hexadecimal coded ASCII	
3	[System reservation]	48-bits hexadecimal coded ASCII	
4	Second Damage Limit Option Enable/Disable setting	8-bits hexadecimal coded ASCII	
5	First Damage Limit Warning Enable/Disable setting	8-bits hexadecimal coded ASCII	
6	Pump Runtime Over Warning Enable/Disable setting	8-bits hexadecimal coded ASCII	
7	Pump Runtime Over Warning Hours setting (×100 hours)	32-bits hexadecimal coded ASCII	
8	Imbalance Warning Enable/Disable setting	8-bits hexadecimal coded ASCII	

Parameter	Item	Data format	Remarks
9	Pump Overload Warning Enable/Disable setting	8-bits hexadecimal coded ASCII	
10	Pump Overload Warning Motor current setting	16-bits hexadecimal coded ASCII	0.1 % step
11	Pump Overload Warning Rotational speed setting	16-bits hexadecimal coded ASCII	0.1 % step
12	Serial communication time out setting (Unit: sec.)	16-bits hexadecimal coded ASCII	60 sec. step
13	[System reservation]	88-bits hexadecimal coded ASCII	

**1 - Valid only with TMS specification.*

Table 13 Parameter setting value

Parameter	Item	Setting range
1	Input operation port setting	I/O REMOTE (X2 REMOTE): 01_{hex} COM1 (X3 COM1): 02_{hex} STP-LINK (X5 STP-LINK): 06_{hex}
2*1	TMS Option Enable/Disable setting	00_{hex}: ENABLE FF_{hex}:DISABLE
4	Second Damage Limit Option Enable/Disable setting	00_{hex}: ENABLE FF_{hex}:DISABLE
5	First Damage Limit Warning Enable/Disable setting	00_{hex}: ENABLE FF_{hex} :DISABLE
6	Pump Runtime Over Warning Enable/Disable setting	00_{hex}: ENABLE FF_{hex} :DISABLE
7	Pump Runtime Over Warning Hours setting	0 to 1,000×100 hours (00000000_{hex} to $000003E8_{hex}$)
8	Imbalance Warning Enable/Disable setting	00_{hex}: ENABLE FF_{hex}: DISABLE
9	Pump Overload Warning Enable/Disable setting	00_{hex}: ENABLE FF_{hex}: DISABLE
10	Pump Overload Warning Motor current setting	0 to 1,000×0.1 % (0000_{hex} to $03E8_{hex}$)
11	Pump Overload Warning	0 to 1,000×0.1 %

Parameter	Item	Setting range
	Rotational speed setting	(0000_{hex} to $03E8_{hex}$)
12	Serial communication time out setting	0 to 30,000sec. (0000_{hex} to 7530_{hex}) Round down to the 60 seconds Set to 0 to disable function

**1 - Valid only with TMS specification.*

Example:

1	Input operation port	01_{hex} = I/O REMOTE
2	TMS Option:	FF_{hex} = DISABLE
4	Second Damage Limit Option	00_{hex} = ENABLE
5	First Damage Limit Warning	00_{hex} = ENABLE
6	Pump Runtime Over Warning	FF_{hex} = DISABLE
7	Pump Runtime Over Warning hours	$000003E8_{hex}$ = 1,000 (×100 hours)
8	Imbalance Warning	00_{hex} = ENABLE
9	Pump Overload Warning	FF_{hex} = DISABLE
10	Pump Overload Warning Motor current	$03E8_{hex}$ = 1,000 (×0.1%)
11	Pump Overload Warning Rotational speed	0000_{hex} = 0 (×0.1%)
12	Serial communication time out	$003C_{hex}$ = 60 sec

Parameter	1		2		3												4		5	
ASCII	0	1	F	F	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	0	0	0	0
HEX	30	31	46	46													30	30	30	30

Parameter	6		7								8	
ASCII	F	F	0	0	0	0	0	3	E	8	0	0
HEX	46	46	30	30	30	30	30	33	45	38	30	30

Parameter	9		10				11				12				13					
ASCII	F	F	0	3	E	8	0	0	0	0	0	0	3	C	*1	*1	*1	*1	*1	*1
HEX	46	46	30	33	45	38	30	30	30	30	30	30	33	43						

Parameter	13															
ASCII	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1
HEX																

**1 - System reservation.*

5.17 SetOptionFunc

CAUTION: ENDURANCE LIMIT

Risk of damage to the equipment. There is an endurance limit of setting changes (do not change more than 24 times per day for about ten years).

If this limit is exceeded, it may become impossible to change the setting and can also cause pump failure. Do not make setting changes in excess of this endurance limit.

Function: Changes the setting value of the input operation port, warning function and serial communication time out.

Transmission frame:

						*1			
PC->SIM	Stx	0	0	1	Sp	=	Parameter 1 to 13	Etx	LRC
SIM->PC									Ack

PC->SIM							Ack
SIM->PC	Stx	0	0	1	#	Etx	LRC

**1 - The HEX code of ASCII character ' = ' is "3D".*

Parameter	Item	Data format	Remarks
1	Input operation port setting	8-bits hexadecimal coded ASCII	Default 01_{hex} (I/O REMOTE)
2*1	TMS Option Enable/Disable setting	8-bits hexadecimal coded ASCII	Default FF_{hex} (DISABLE)
3	[System reservation]	48-bits hexadecimal coded ASCII	*2
4	Second Damage Limit Option Enable/Disable setting	8-bits hexadecimal coded ASCII	Default 00_{hex} (ENABLE)
5	First Damage Limit Warning Enable/Disable setting	8-bits hexadecimal coded ASCII	Default 00hex (ENABLE)

Parameter	Item	Data format	Remarks
6	Pump Runtime Over Warning Enable/Disable setting	8-bits hexadecimal coded ASCII	Default FF_{hex} (DISABLE)
7	Pump Runtime Over Warning Hours setting (×100 hours)	32-bits hexadecimal coded ASCII	Default 00000000_{hex}
8	Imbalance Warning Enable/Disable setting	8-bits hexadecimal coded ASCII	Default 00_{hex} (ENABLE)
9	Pump Overload Warning Enable/Disable setting	8-bits hexadecimal coded ASCII	Default FF_{hex} (DISABLE)
10	Pump Overload Warning Motor current setting	16-bits hexadecimal coded ASCII	Default 03E8hex (100.0%)
11	Pump Overload Warning Rotational speed setting	16-bits hexadecimal coded ASCII	Default 0000_{hex} (0.0%)
12	Serial communication time out setting (Unit: sec.)	16-bits hexadecimal coded ASCII	Default $003C_{hex}$ (60 sec.)
13	[System reservation]	88-bits hexadecimal coded ASCII	*2

**1 - Valid only with TMS specification*

**2 - Assign the parameter value Fhex or the reading data of ReadOptionFunc (?=)*

Refer to *Table: Parameter setting value* for each parameter setting value.
The value is not reflected when a parameter is out of a setting range.

Example:

1	Input operation port	01_{hex} = I/O REMOTE
2	TMS Option	FF_{hex} = DISABLE
4	Second Damage Limit Option	00_{hex} = ENABLE
5	First Damage Limit Warning	00_{hex} = ENABLE
6	Pump Runtime Over Warning	FF_{hex} = DISABLE
7	Pump Runtime Over Warning hours	$000003E8_{hex}$ = 1,000 (×100 hours)
8	Imbalance Warning	00_{hex} = ENABLE
9	Pump Overload Warning	FF_{hex} = DISABLE
10	Pump Overload Warning Motor current	$03E8_{hex}$ = 1,000 (×0.1%)

11	Pump Overload Warning Rotational speed	0000_{hex} = 0 (×0.1%)
12	Serial communication time out	$003C_{hex}$ = 60 sec

Parameter	**1**		**2**		**3**												**4**		**5**	
ASCII	0	1	F	F	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	0	0	0	0
HEX	30	31	46	46													30	30	30	30

Parameter	**6**		**7**								**8**	
ASCII	F	F	0	0	0	0	0	3	E	8	0	0
HEX	46	46	30	30	30	30	30	33	45	38	30	30

Parameter	**9**		**10**				**11**				**12**				**13**					
ASCII	F	F	0	3	E	8	0	0	0	0	0	0	3	C	*1	*1	*1	*1	*1	*1
HEX	46	46	30	33	45	38	30	30	30	30	30	30	33	43						

Parameter	**13**															
ASCII	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1	*1
HEX																

**1 - Assign Fhex or the reading data of ReadOptionFunc (?=).*

5.18 ReadCondition

Function: Reads the pump model and damage point.

Transmission frame:

						*1		
PC→SIM	Stx	0	0	1	?	{	Etx	LRC
SIM→PC								Ack

PC→SIM	*1							Ack
SIM→PC	Stx	0	0	1	Sp	{	Parameter 1 to 4	Etx	LRC

**1 - The HEX code of ASCII character ' { ' is "7B".*

Parameter	Item	Data format	Remarks
1	Pump model	160-bits hexadecimal coded ASCII	
2	[System reservation]	32-bits hexadecimal coded ASCII	
3	Damage point	16-bits hexadecimal coded ASCII	
4	[System reservation]	64-bits hexadecimal coded ASCII	

Example:

1	Pump model	6E455854203238303720 4D202020202020202020 hex = nEXT 2807 M
2	Damage point	32hex = 50

Parameter	**1**																			
	"n"		"E"		"X"		"T"		" "		"2"		"8"		"0"		"7"		" "	
ASCII	6	E	4	5	5	8	5	4	2	0	3	2	3	8	3	0	3	7	2	0
HEX	36	45	34	35	35	38	35	34	32	30	33	32	33	38	33	30	33	37	32	30

Parameter	**1**																			
	"M"		" "		" "		" "		" "		" "		" "		" "		" "		" "	
ASCII	4	D	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0
HEX	34	44	32	30	32	32	32	30	32	30	32	30	32	30	32	30	32	30	32	30

Parameter	**2**								**3**				**4**							
ASCII	*1	*1	*1	*1	*1	*1	*1	*1	0	0	3	2	*1	*1	*1	*1	*1	*1	*1	*1
HEX									30	30	33	32								

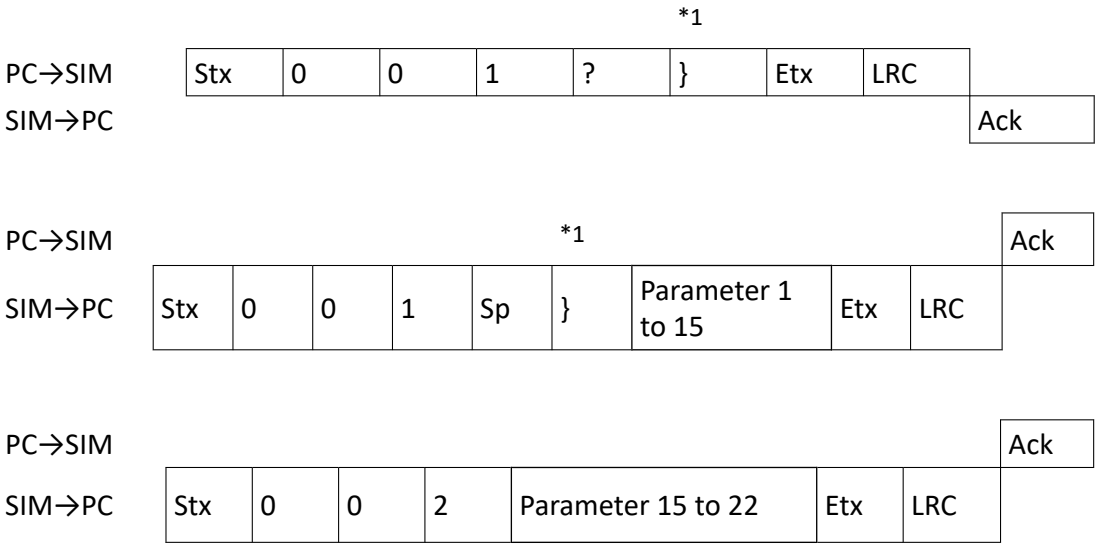
Parameter	**4**							
ASCII	*1	*1	*1	*1	*1	*1	*1	*1
HEX								

**1 - System reservation*

5.19 ReadEventsWithTime

Function: Reads the "Error Record" with detection time.

Transmission frame:



**1 - The HEX code of ASCII character ' } ' is "7D".*

Parameter	Item	Data format	Remarks
1	The number of "Error Record"	8-bits hexadecimal coded ASCII	
2	The maximum number of "Error Record"	8-bits hexadecimal coded ASCII	Up to 20 for nEXT Maglev pumps
3 to 22	Error Record 1 to Error Record 20	80-bits hexadecimal coded ASCII (See "Error Record Format")	*1

**1 - The recent error has the smallest parameter number.*

Error record format:

Time information of error history has two formats that depend on the pump model.

- Total running time of the pump and control unit
- Real time data by a built-in clock.

Time information is identified with a time flag.

This pump uses the format in the case of time flag = 0.

In case of time flag = 0

Parameter	Item	Data format	Remarks
a	Error Code	8-bits hexadecimal coded ASCII	*1
b	Time flag	8-bits hexadecimal coded ASCII	

Parameter	Item	Data format	Remarks
c	Pump running time	32-bits hexadecimal coded ASCII	Unit: minute
d	Control unit running time	32-bits hexadecimal coded ASCII	Unit: minute

**1 - Value corresponding to the error is transmitted (refer to Table: Error message values). When the number of errors being detected is under the maximum number, the value of parameter that is larger than the number of errors being detected is set to FF_{hex}.*

Example:

In case of Disturbance X_H detection at

Pump running time = 5,000 minutes, control unit running time = 6,000 minutes

Parameter	a		b		c								d							
ASCII	0	D	0	0	0	0	0	0	1	3	8	8	0	0	0	0	1	7	7	0
HEX	30	44	30	30	30	30	30	30	31	33	38	38	30	30	30	30	31	37	37	30

In case of time flag = 1

Parameter	Item	Data format	Remarks
a	Error Code	8-bits hexadecimal coded ASCII	*1
b	Time flag	8-bits hexadecimal coded ASCII	
c	Error detection time (Format：yymmddhhnn) yy: The last two digits of the year mm: Month dd: Day hh: Hour (24-hour display) nn: Minute	40-bits hexadecimal coded ASCII	*2
d	[System reservation]	24-bits hexadecimal coded ASCII	

**1 - Value corresponding to the error is transmitted (refer to Table: Error message values). When the number of errors being detected is under the maximum number, the value of parameter that is larger than the number of errors being detected is set to FF_{hex}.*

**2 - Each value of time is transmitted as BCD form character string.*

Example:

In case of Disturbance X_H detection at September 13, 2007 12: 34

Parameter	a		b		c								d							
ASCII	0	D	0	1	0	7	0	9	1	3	1	2	3	4	*3	*3	*3	*3	*3	*3
HEX	30	44	30	31	30	37	30	39	31	33	31	32	33	34						

**3 - System reservation*

Example:
When 3 errors have been detected in the past

The number of "Error Record"	03_{hex} = 3 errors
The maximum number of "Error Record"	14_{hex} = 20 errors
Error Record 1:	Error Code $0F_{hex}$ = 15 = Disturbance Xb
	Time flag 01_{hex} = Detection time is built-in clock time
	Error detection time 0709131234_{hex} = Sep. 13, 2007 at 12:34
Error Record 2:	Error Code $0D_{hex}$ = 13 = Disturbance Xh
	Time flag 01_{hex} = Detection time is built-in clock time
	Error detection time 0704300659_{hex} = Apr. 30, 2007 at 06:59
Error Record 3	Error Code 12_{hex} = 18 = MOTOR Overheat
	Time flag 01_{hex} = Detection time is built-in clock time
	Error detection time 0612011508_{hex} = Dec. 1, 2006 at 15:08
Error Record 4 to 20	No error recorded

Parameter	1		2	
ASCII	0	3	1	4
HEX	30	33	31	34

Parameter	3a		3b		3c										3d						
ASCII	0	F	0	0	0	7	0	9	1	3	1	2	3	4	*1	*1	*1	*1	*1	*1	
HEX	30	46	30	30	30	37	30	39	31	33	31	32	33	34							

Parameter	4a		4b		4c										4d						
ASCII	0	D	0	0	0	7	0	4	3	0	0	6	5	9	*1	*1	*1	*1	*1	*1	
HEX	30	44	30	30	30	37	30	34	33	30	30	36	35	39							

Parameter	5a		5b		5c										5d					
ASCII	0	F	0	0	0	6	1	2	0	1	1	5	0	8	*1	*1	*1	*1	*1	*1
HEX	30	46	30	30	30	36	31	32	30	31	31	35	30	38						

Parameter	6a		6b		6c										6d					
ASCII	F	F	0	0	0	0	0	0	0	0	0	0	0	0	*1	*1	*1	*1	*1	*1
HEX	46	46	30	30	30	30	30	30	30	30	30	30	30	30						

Parameter	7a		7b								21d					
ASCII	F	F	0	0			[Omitted]		0	0	*1	*1	*1	*1	*1	*1
HEX	46	46	30	30					30	30						

Parameter	22a		22b		22c										22d					
ASCII	F	F	0	0	0	0	0	0	0	0	0	0	0	0	*1	*1	*1	*1	*1	*1
HEX	46	46	30	30	30	30	30	30	30	30	30	30	30	30						

**1 - System reservation*

5.20 SetOptions

Function: Changes the setting value of optional function. The parameter n depends on the optional function.

Transmission frame:

						*1			
PC->SIM	Stx	0	0	1	Sp	0	Parameter 1 to n	Etx	LRC
SIM->PC									Ack

PC->SIM							Ack
SIM->PC	Stx	0	0	1	#	Etx	LRC

**1 - HEX code of the ASCII character '0' is "30".*

Parameter	Item	Data format	Remark
1	Optional function number	16-bits hexadecimal coded ASCII	refer *Table: Option function number and parameter list*
2 to n	Function item		

Table 14 Option function number and parameter list

Optional function number	Value	Total parameter n	Remark
Second speed option setting	0014	3	Refer to *Second speed option setting* on page 58.
Second speed selection	0015	2	Refer to *Second speed selection* on page 59.

5.20.1 Second speed option setting

CAUTION: ENDURANCE LIMIT

Risk of damage to the equipment. There is an endurance limit of setting changes (do not change more than 24 times per day for about ten years). If this limit is exceeded, it may become impossible to change the setting and can also cause pump failure. Do not make setting changes in excess of this endurance limit.

Settings for second speed can be changed.

Parameter	Item	Data format	Remark
1	Optional function number	16-bits hexadecimal coded ASCII	0014 hex
2	Second speed setting (Unit: Hz)	16-bits hexadecimal coded ASCII	*1
3	Second speed option setting	16-bits hexadecimal coded ASCII	0000 hex : DISABLE 00FF hex : ENABLE

**1 - This value can be changed in the range from half of the rated rotational speed to the rated rotational speed. When the parameter value is larger than the rated rotational speed, it is automatically set to the rated rotational speed. When the parameter value is smaller than half of rated rotational speed, it is automatically set to half of rated rotational speed.*

Example:

Second speed setting	0190hex = 400 Hz = 24000 rpm
Second speed option setting	0000hex = DISABLE

Parameter	1				2				3			
ASCII	0	0	1	4	0	1	9	0	0	0	0	0
HEX	30	30	31	34	30	30	39	30	30	30	30	30

5.20.2 Second speed selection

The normal rating speed setting or second rating speed setting can be selected in the normal state.

When using this function, set the second speed option to the "ENABLE".

Parameter	Item	Data format	Remark
1	Optional function number	16-bits hexadecimal coded ASCII	0015 hex
2	Second speed selection	16-bits hexadecimal coded ASCII	0000 hex: Normal rating speed setting 0001 hex: Second rating speed setting

Example:

Second speed selection	0000hex = Normal rating speed setting

Parameter	1				2			
ASCII	0	0	1	5	0	0	0	0
HEX	30	30	31	35	30	30	30	30

5.21 ReadOptions

Function: Reads the setting value of optional function. The parameter n depends on the optional function.

Transmission frame:

					*1					
PC->SIM	Stx	0	0	1	?	0	Parameter 1	Etx	LRC	
SIM->PC										Ack

PC→SIM					*1					Ack
SIM→PC	Stx	0	0	1	Sp	0	Parameter 1 to n	Etx	LRC	

**1 - HEX code of the ASCII character '0' is "30".*

Parameter	Item	Data format	Remark
1	Optional function number (receive/return)	16-bits hexadecimal coded ASCII	Refer to *Table: Option function number and parameter list*.
2 to n	Function items (return)		

Table 15 Option function number and parameter list

Optional function number	Value	Total response parameter n	Remark
Second speed option setting	0014	4	Refer to*Second speed function setting* on page 60.
Second speed selection	0015	2	Refer to *Second speed select* on page 60.

5.21.1 Second speed function setting

Settings for second speed can be changed.

Parameter	Item	Data format	Remark
1	Optional function number	16-bits hexadecimal coded ASCII	0014 hex
2	Second speed setting (Unit: Hz)	16-bits hexadecimal coded ASCII	
3	Second speed option setting	16-bits hexadecimal coded ASCII	0000 hex：DISABLE 00FF hex：ENABLE
4	Selected speed value (Unit: Hz)	16-bits hexadecimal coded ASCII	

Example:

Second speed setting	0190hex = 400 Hz = 24000 rpm
Second speed option setting	0000hex = DISABLE
Selected speed value	0260hex = 608 Hz = 36500 rpm (Normal rating speed setting)

Parameter	1				2				3				4			
ASCII	0	0	1	4	0	1	9	0	0	0	0	0	0	2	6	0
HEX	30	30	31	34	30	31	39	30	30	30	30	30	30	32	36	30

5.21.2 Second speed select

The speed setting set as rotational speed in the normal state can be read.

Parameter	Item	Data format	Remark
1	Option function number	16-bits hexadecimal coded ASCII	0015 hex
2	Second speed selection	16-bits hexadecimal coded ASCII	0000 hex: Normal rating speed setting 0001 hex: Second rating speed setting

Example:

Second speed selection	0000hex = Normal rating speed setting

Parameter	1				2			
ASCII	0	0	1	5	0	0	0	0
HEX	30	30	31	35	30	30	30	30

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